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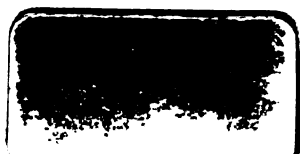


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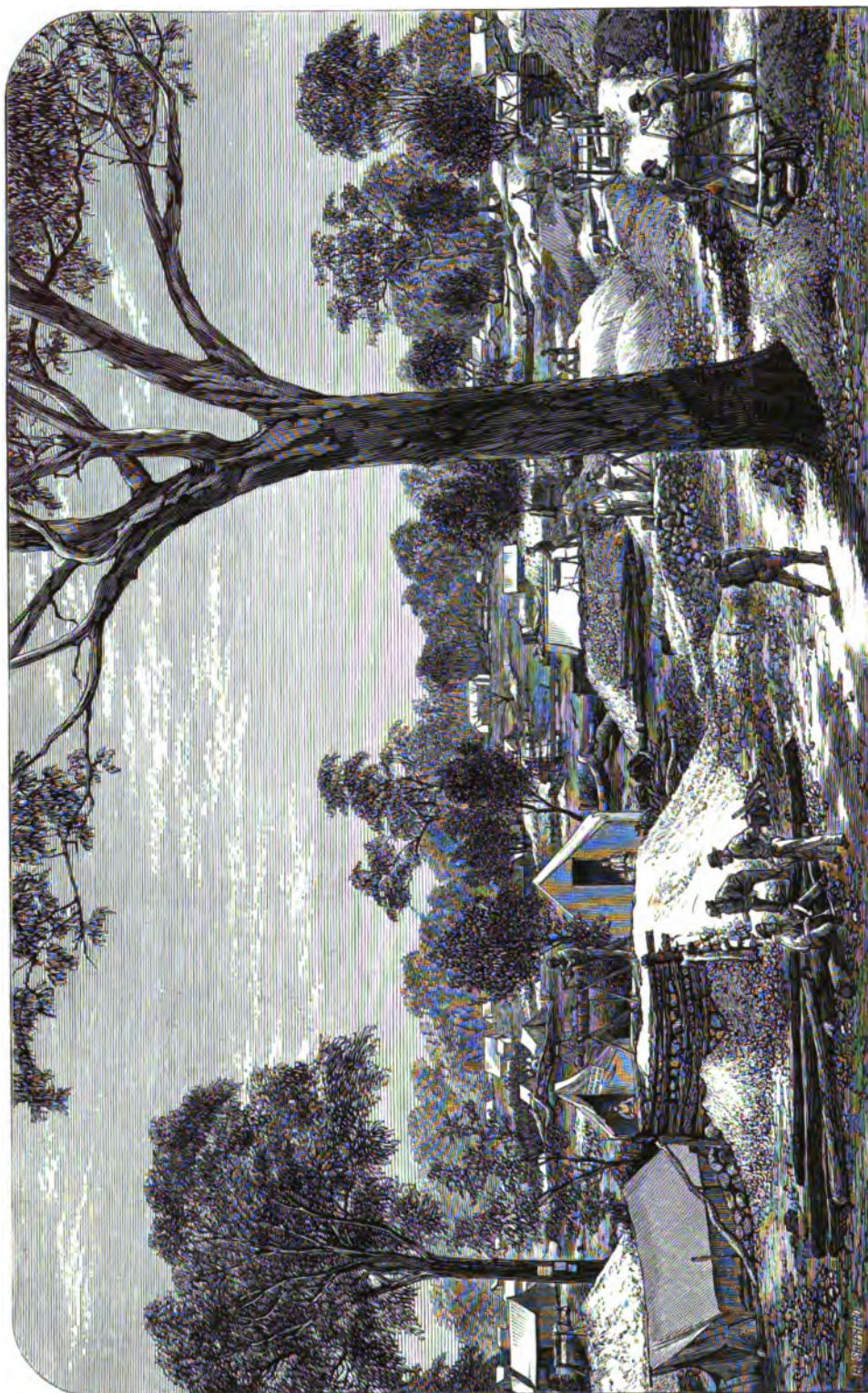
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From a photograph by R. Dainton.

RUSH NEAR NAVARRE.

THE
GOLD FIELDS

AND

Mineral Districts of Victoria,

WITH

NOTES ON THE MODES OF OCCURRENCE OF GOLD AND OTHER
METALS AND MINERALS;

BY R. BROUGH SMYTH, F.G.S.,

ASSOC. INST. C. E., HON. COR. MEM. OF THE SOCIETY OF ARTS AND SCIENCES OF UTRECHT,
SECRETARY FOR MINES FOR THE COLONY OF VICTORIA,
ETC., ETC., ETC.



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INTRODUCTION.

As far back as 1858 it was suggested by the Honorable Andrew Clarke, R.E., that the interests of the colony would be promoted by the publication of scientific papers, on the plan of the Memoirs of the Geological Survey of Great Britain, and some steps were taken to give effect to his proposals. It was contemplated in his scheme that the gentlemen having the charge of the several scientific departments under the control of the Government should contribute papers relating to subjects of scientific investigation, and that a volume should be published yearly. The late Honorable W. C. Haines, at that time Chief Secretary of the Colony, approved of the plan; and, under his instructions, materials were collected for the first volume. Mr. Clement Hodgkinson's Report of his Explorations in the Valley of the River Murray, and some scientific papers which had been presented to Parliament, were made ready for the printer; but at this stage it was ascertained that the scheme was not viewed favorably by the gentlemen from whom contributions were expected, and it was at length reluctantly abandoned.

The first volume was never published, and but for the dissemination since, from time to time, of short reports at irregular intervals, and not on any plan providing for connection or continuity, the public might suppose that very little had been done to advance the interests of science in Victoria.

If this is the impression it is an erroneous one. The scientific journals of Europe contain many useful papers, full of valuable facts, which have been contributed by the heads of the scientific departments in this colony; and though perhaps it would have been more beneficial to our interests if they had been published here, there is neither cause for serious complaint nor room for much regret. They have operated beneficially, and they are sufficient proofs that those occupying responsible positions have not been idle.

The advantages which would have been gained by the publication of scientific papers, after a regular system, would have compensated for any inconveniences which might have been caused to the writers. The results of their labors would have been placed fairly before the public; each person would have enjoyed similar privileges; the papers would have been illustrated by appropriate drawings, diagrams, and plans; a groundwork would have been laid for a physical atlas; the public would have had easy access to all the various sources of information; and the cost of printing and publishing huge volumes of useless figures and masses of irrelevant, uninteresting, departmental correspondence would have been saved.

His Honor Sir Redmond Barry conceived the scheme of publishing Prefatory Essays, indicating the Progress, Resources, and Physical Characteristics of the Colony, together with the catalogue of the Victorian Exhibition of 1861, and the results came little short, it is believed, of the estimate originally formed; yet the better plan, though approached by this, has not until lately received the consideration it deserves.

The Honorable John Macgregor, when holding the office of Minister of Mines, asked me more than once whether it was not possible to prepare a comprehensive Report on the Goldfields and Mineral Districts, embracing information and statistics relating to the number of miners employed, machinery, results of quartz crushing, and operations connected with mining for the ores of silver, tin, antimony, &c., which would bring the history of our labors up to a definite period, and prepare the way for a more complete tabulation of figures than has yet been given; and when he was told that it could be done, he gave so much encouragement to the scheme, that a commencement was made at once to collect materials for the work.

At the same time the Honorable S. H. Bindon (formerly Minister of Justice) suggested that better means of illustrating scientific papers and a more regular publication of them were desirable and necessary; and when he was made acquainted with the nature of the work in progress, he was much interested in it, and, as regards the illustrations, facilitated the preliminary arrangements in such a manner as to relieve me of much anxiety.

I am equally indebted to the Honorable J. J. Casey, now Minister of Justice; and who has under his control the Government printing establishment.

The Honorable J. F. Sullivan, who for some years presided over the Mining Department, and is again the Minister of Mines for the Colony, has also approved of these efforts; and for his friendly hints, and to his wise counsel, I am much indebted. Having closely observed the physical features of the goldfields of California, as well as those in this colony, his opinions are justly entitled to consideration.

This encouragement and this help were given, it is feared, under the impression that the results would be far more valuable than they are. But a beginning has been made—one step has been taken—and it may hereafter lead to very profitable and useful results. Even the discussion of questions raised in this paper will not be devoid of utility; because, undoubtedly, many new facts, now held back, will be put prominently forward when the occasion is given for bringing them forth.

Better than anyone else, I know that the work, in other hands, would have been done more satisfactorily. I feel that I have neither the knowledge nor experience to make it perfect or complete; but, having opportunities of collecting and correlating facts not possessed by others who are better capable of illustrating a science, I have thought it right to give as much as I can; and this is stated, not by way of apology, but as a simple matter of fact.

I wish it to be understood that I am merely a compiler.

The end in view is the dissemination of authentic information for the use of miners; and descriptions and statements of the results of mining operations have been got from the best sources, and in all cases the names of the contributors are given.

Use has been made of the maps and reports furnished by the mining registrars and surveyors and the geological surveyors, and the maps issued by the Surveyor-General, and many private maps, plans, and sections furnished by mining companies and mining managers.

To Mr. Thomas Couchman, the Chief Mining Surveyor, for many highly interesting papers, plans, and sections; to Mr. C. W. Ligar, who has cheerfully given assistance in the preparation of the lithographic plans; to Mr. H. Wood, district registrar, for a valuable history of the deep *leads* at Ballaarat; and to Mr. Selwyn, who has kindly permitted the re-publication of his beautiful sketch-section showing the modes of the occurrence and the character of the rocks in the colony—my thanks are more especially due.

It is my duty also to record my appreciation of the ready help which has been given by the mining managers, mine owners, mining surveyors, and mining registrars whose names are found in this volume; as well as of the cordial co-operation, when it has been required, of the gentlemen in the Office of Mines in Melbourne.

The review of the laws by which the interests of the miners have been affected, from the first discovery of gold up to the present time, has been prepared by John Atkins, Esquire, barrister-at-law. Written by an able lawyer, and solely for the purpose of elucidating changes in policy and the consequent amendments of the law which such changes made necessary, it will serve as a guide to the legislator both in this and other countries where mining is an important industry.

The attention bestowed on the typography and illustrations by Mr. John Ferres, the Government Printer, is only what might have been expected from a gentleman who has already received deserved encomiums from those in Europe best able to judge of his work. If all the maps and sections had been prepared in his office there would have been no cause for regret.

It is perhaps necessary to state—not for my own sake, but for the information of the public—that this volume has been compiled in my leisure hours, and the work of preparing it has never been allowed to interfere in any way with the discharge of my public duties.

It is probable that the facts which are communicated will, in some minds, excite surprise. The colony, its resources, and its inhabitants, are apparently less studied by Englishmen than Japan, the Sandwich Islands, or New Caledonia; and, judging from the articles which appear in the newspapers and reviews which are published in England, it seems that less is known of our country than of Tasmania or Norfolk Island.

I have no hope that anything I have written will serve to attract attention to the colony. Indeed the work is designed principally for the use of the miners resident here; but if the papers I have brought together be studied by geologists in England and explorers in India, many of the old goldfields will be re-opened, and veins and deep *leads* will be discovered in places where, according to the theories now generally received, there is no prospect of getting any more gold.

So long as mystery and what one may regard as superstition surround the observer, and darken his view, there is, indeed, little prospect of advancement; but our miners have cleared away some of the thick fogs; and, finally, it may be believed, even by the older teachers, that where the dust of gold is found there must be some source of it, and that that cannot be remote from the spot where the golden sands are found. There are surely veins of gold, or else our miners are wizards of a strange sort.

During a period of nearly fifty years—from the first discovery of the waters of Port Phillip Bay, in February, 1802, until the finding of gold at Clunes, in March, 1850—it was believed that the southern part of the island-continent of Australia was so much almost useless land lying in the way of the navigator, and probably profitable only to such hardy pioneers as might take sheep and cattle and horses to it from Tasmania and New South Wales.

The records of explorations by the Spaniards in America, and the accounts given of the auriferous alluviums of the Ural, and the trustworthy reports on the silurian rocks of Wales and Scotland and Ireland are not generally accessible, nor are they sought for; and therefore it never occurred to the first explorers that the rocks of this country were not dissimilar in their character to those in which such vast quantities of gold had been obtained in Europe and America.

For more than twenty-five years the colony was traversed in all the more accessible parts by gentlemen of education, and by men who had previously been engaged in mining or who were acquainted with mineral districts; and some places, since ascertained to be rich in gold, were occupied for years by shepherds and stockmen who must have had occasion very frequently to disturb the soil in which quite large pieces of gold were embedded; and yet no one ventured to assert that the land lying to the south of the Murray River was likely to be occupied for other than pastoral purposes. Every district was valued solely in proportion to the number of sheep or cattle which each acre would carry.

Reefs of white quartz, standing twenty feet above the surrounding surface, every foot of which contained gold visible to the naked eye, excited neither curiosity nor enquiry; and the careless shepherd, whose earnings amounted to no more than ten or fifteen shillings a week, every day drew water from the creek beneath whose bed lay nuggets and grains of gold far exceeding in value the fee-simple of the run on which he was a laborer.

This may be accounted for partly by the peculiar circumstances under which the colony was first occupied ; but was mainly owing, undoubtedly, to the want of knowledge of gold mines and their characteristics which was common to the Australian explorers as to others in some parts of America and Africa and India.

Until we were made acquainted with the results of the labors of Sir William Logan in Canada and Professor Whitney in California, the geology of gold-producing countries was as completely sealed to the ordinary reader as if the mines had been in another sphere. And even now so little is known that the best informed amongst geologists are willing to admit that the enquiry has only commenced.

Large areas in Europe, in Asia, in Africa, and America, and vast tracts in Australia—and many islands lying to the north of our island-continent—are yet, as regards results, unexplored ; and at any time there may be discovered fields as rich and as permanent as those developed in Victoria.

The general appearance of a gold-producing country is not such as to attract the attention of the ordinary traveller. He might pass over it again and again and never suspect that it contained the most valuable of the metals.

In districts where coal or ironstone occurs it is easy for even the inexperienced observer to collect useful information relative to those minerals ; they are conspicuous ; they crop out in such a way as at once to engage attention ; and it is not remarkable therefore that Hovell and Hume should have found coalfields at Cape Patterson in 1828, and that none of their successors discovered gold in quantities sufficient to attract attention until after the lapse of many years.

The common ores may be recognised by the most ignorant, but a stranger in a strange land would scarcely credit the evidence of his senses if he saw gold. He would at the same time, in all probability, see iron pyrites and mica, and it would not occur to him that the treasures which, in his youth, he had considered as belonging only to a few favored spots of the earth could be revealed in a place whose value was measured by the grass which it grew.

It is known that from time to time pieces of gold were collected and sold by some of the laborers on the sheep stations shortly after the colony was occupied ; but the discovery was regarded with suspicion. No one knew the source from whence the metal was obtained, and no enquiries were made until the subject was forced upon the attention of the colonists by the discovery of gold in New South Wales.

The rapid strides which have been made by this colony since the opening of the goldfields in 1851 ; the vast amount of reproductive labor performed ; the skill exhibited in works requiring for their proper construction and management much knowledge, and, in some cases, the application of principles but little studied ; the extensive tracts opened up and explored ; and, during this period, the social advancement of the people—so suddenly brought in contact with new phases of

life—are not depicted in this volume; but from what is stated in regard to the operations of the miners, it will be easy for the intelligent reader to draw conclusions which will throw some light on subjects which are not touched upon.

If the tone adopted in this work is hopeful, and even sanguine, when directing attention to the vast areas which have not yet been explored by the miner, it may be pleaded that past events justify it. When the first important discovery of gold was made in Victoria we were told by the highest authorities that the shallow alluviums would soon be exhausted, and when that time arrived the colony would be burdened with a dissolute population, who, when their avocation—a kind of gambling—was gone, would bring ruin upon the country. When the quartz veins were opened and the riches they contain were ascertained we were informed that vein-mining is never profitable beyond a depth of sixty or seventy feet, and that we should invest no capital in adventures which the history of gold-mining has told us are never profitable. When the rich deep *leads* were traced under the basalt at Ballarat we were warned against being over-sanguine, as the occurrence of such deposits was merely local.

Fortunately for the colony, these prophecies have not been fulfilled. We can point to several towns depending wholly on the mines for their support, and inhabited by miners, where order and regular industry are conspicuous, where substantial and well conducted institutions for the relief of suffering and the spread of knowledge have been originated, and are now supported by the miners, and where municipal laws are more cheerfully obeyed than in any town in England. In such places we can see the miner, in the intervals of his labor, cultivating a garden which surrounds a cottage better in appearance, and more comfortable in its arrangements, than many which in England are inhabited by those who do not depend on the labor of their hands for their support. And under no circumstances—not even where thousands congregate on a new goldfield—are we justified in saying that the miners of Victoria are not immensely superior to the classes that are employed in mines in Europe.

The shallow alluviums are not yet completely exhausted anywhere, and thousands of square miles are yet untouched. Our quartz veins, notwithstanding the expenses incident to the procuring of the vein-stuff from depths exceeding 700 feet, maintain their character; and may, because of their value and the great horizontal and vertical extent of them, hereafter exceed in importance even the deep *leads*.

The deep *leads* are not confined to the district of Ballarat, but extend over an area so extensive that it is impossible to say when the last of them will be opened.

As regards his material interests, perhaps the prospects of the Victorian miner were never brighter than they are at present.

The tables in the Appendices convey concisely much information respecting the past and present condition of our mines.

The gross produce, from the first discovery of the goldfields, in 1851, to the 31st December, 1868, is as follows:—

	£	£
<i>Gold</i> :—Quantity exported from the date of the first discovery to the 31st December, 1868, 36,835,691½ ozs.,* at £4 per oz.	-	147,342,767
<i>Silver</i> :—Ore raised, 11,348 tons.		
Produce of silver from ore treated, 18,353 ozs. 8 dwts., at 5s. 6d. per oz.	- - - - -	5,047
<i>Tin</i> :—Ore exported, 2,601 tons 2 cwt.	- - -	192,936
„ 92 tons 9 cwt., at £70 per ton	- -	6,471
„ 177½ tons, at £52 10s. per ton	- -	9,318
Tin exported, say 3 tons 12 cwt. 3 qrs. 12 lbs., at £140 per ton	- - - - -	510
„ 7 tons 16 cwt.	- - - - -	729
		209,964
<i>Copper</i> :—Ores raised, about 855 tons.		
Smelted, 31 tons 7 cwt., at £112 per ton	- - -	3,511
Regulus, 70 tons 16 cwt.	- - -	1,969
Rough copper, 10½ tons	- - -	320
		5,800
<i>Antimony</i> :—Ore raised, 2,955 tons 15 cwt. 0 qrs. 26 lbs.	- - -	32,102
„ 435 tons, at £6 per ton	- - -	2,610
„ 272 tons, at £9 per ton	- - -	2,448
		37,160
<i>Coal</i> :—1,933 tons, at £1 10s. per ton	- - -	2,899
<i>Lignite</i> :—235 tons, at 17s. 6d. per ton	- - -	205
<i>Kaolin</i> :—1,757 tons, at £4 per ton	- - -	7,028
<i>Flagging</i> :—57,500 square yards	- - -	19,425
1,200 tons	- - -	2,100
		21,525
<i>Slates</i> :—1,000, at £8 per 1,000	- - -	8
160 tons, at £4 per ton	- - -	640
		648
<i>Magnesite</i> :—6½ tons, at £2 per ton	- - -	12
<i>Diamonds</i> :—About 81 carats	- - -	81
<i>Sapphires</i> :—Sapphires, numbers cannot be estimated—say	- -	150
		£147,643,286

Taking the mean number of miners employed exclusively in getting gold during the eighteen years from 1851 to 1868 inclusive, and dividing the value of the gold as here estimated by that number we find that the average per man is

* From returns furnished by the Honorable the Commissioner of Trade and Customs, and inclusive of 1,267,241 ozs., which, according to the Registrar-General's tables, were produced in Victoria in 1852-5 but passed through the Customs of New South Wales, Tasmania, and South Australia, and not recorded in Victorian tables. The quantities used and manufactured in the colony cannot be estimated.

£1,699 8s. 3d., or £98 10s. 4d. per annum. These figures are no true test of the success of individuals; but they show that gold mining is in the main a profitable pursuit.

In one year—1852—the average earnings were as high as £262 11s. 6d., and in 1862 as low as £67 14s. 5d.; but from this period they gradually increased, and in 1868 they were £104 18s. 8d. per man per annum.

The value of the machinery employed by the gold miners is no more than £2,150,432.

The total area of the land held as “claims” under the bye-laws of the Mining Boards and under lease from the Crown was, on the 31st December, 1868, as follows:—

		A.	R.	P.
“Claims” held under the bye-laws	- -	100,941	3	15
Lands held under leases	- - - -	15,337	2	28
		116,279	2	3

The estimated value of all the “claims” in the colony is, according to the information conveyed by the share lists and estimates, £8,869,504.

The number of gold-mining companies registered in the several Courts of Mines up to the 31st December, 1868, is 2,471; the number of shares in those companies, 7,421,492½; and the nominal capital, £24,431,205 10s.

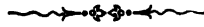
The length of the water races constructed by the gold miners is 2,434 miles 20 chains, and they have cost £310,270, or at the rate of £127 9s. 2d. per mile.

Up to the 31st December, 1868, information has been received relative to the yield of gold from 5,811,669½ tons of vein quartz; and the average per ton is 11 dwts. 12·37 gra. This does not represent all the quartz put through the mills; but if returns could be got from all the quartz crushers, the average probably would not be much affected.

The total amount of revenue derived directly from the goldfields, in the shape of fees for gold licenses, miners’ rights, business licenses, rents, &c., from 1851 to 1868 inclusive, is £5,211,465 19s. 1d.



Mineral Districts.



THE COLONY OF VICTORIA is situate between the meridians of 141° and 150° E. longitude and the parallels of 34° and 39° S. latitude. It is bounded on the north-east and north by a line from Cape Howe to the nearest source of the River Murray, at Forest Hill, and thence by the River Murray to the 141^{st} meridian; on the west by the 141^{st} meridian; and on the south and south-east by the sea.

It is divided naturally into three parts, each dissimilar as regards climate and soils.

The Great Cordillera, which extends southwards from Cape York, has a culminating point at Forest Hill, and it runs thence south-westerly and westerly through the Victorian territory to St. Clair, where it diverges southwards, and forms the dividing range between the waters of the River Yarra and those flowing to the La Trobe. It is traceable thence southwards, for the greater distance, by a well marked watershed, to Wilson's Promontory, and onwards, under the sea, by a chain of islands, to Tasmania.

A great spur stretches westward from St. Clair to the Grampians, whence the line is broken and disconnected.

The coast line throughout the whole eastern extent of Australia conforms rudely to the line of the Cordillera; and the like configuration is observable in Victoria, both as regards the Cordillera and the Great Spur.

The part first in importance, both as regards area and natural features, is that lying to the north-west of the Cordillera and to the north of the Great Spur.

All the waters falling within this area find their way, by tributary streams running northwards, to the River Murray, or are lost in the tertiary sands.

The second part lies to the south of the Great Spur and to the west of the Cordillera, and the streams run southwards to the sea.

The third part is called Gippsland, and lies to the south-east and east of the Cordillera, and the streams run southwards and eastwards to the sea.

The Cordillera from Forest Hill to St. Clair is composed principally of palæozoic rocks. Near Omeo there are masses of granite, porphyry, and limestone, and patches of middle palæozoic and trappean rocks; but its course is nearly altogether through the silurian strata. It is not until we reach Baw-Baw, on the southern extension of the Great Range, that the granite is found abutting on the silurian claystones. The western side of the range is composed of plutonic rocks, and the eastern of sedimentary strata—the summit of the range following the boundary of the rocks, a peculiarity observable in other parts of the colony where these rocks occur. Further southwards the line extends through carboniferous rocks and some patches of porphyry until we

reach Wilson's Promontory, where a mass of granite is found with dykes of quartz, and containing large crystals of tourmaline. A belt of silurian claystones lies between the granitic area and the carboniferous rocks.

It is highly probable that the granite of Wilson's Promontory is connected with that of Baw-Baw, notwithstanding that sedimentary rocks are found between the two areas.

Some writers are of opinion that the Cordillera extends westwards, and that what is here called the Great Spur is in reality the main range. But the Great Spur ends in the Grampians, and a little further on we find the line intersected by the River Murray, which enters the sea at Lake Alexandrina; and if the recent rocks, which form what may justly be termed the modern watershed, were removed, the range would be lost altogether far eastward of the Grampians. If there were an elevation of the mass of land lying to the south, the Cordillera would be connected with Tasmania, and it would form a watershed as distinct in this part of its course as in any other. This is susceptible of proof. The sections across the straits, through the chain of islands, which were prepared some years ago by the late Dr. Ludwig Becker, show that a not very considerable elevation of the land would exhibit the extension of the Cordillera in such a manner as to be convincing.

The eminent geologist and geographer, Mr. Beete Jukes, seems to entertain no doubt as to the direction of the Great Range as here laid down, and indeed the evidence is clear enough. The problem is only made complex when the heights of the axis above the sea-level are taken as guides, rather than other physical characteristics which elsewhere are the only safe indications of such extensions.

The line of the Cordillera in many parts towards the north, now so clear as to be understood by anyone who looks at a map, might, by a very slight change of level, completely lose the character it now exhibits. For instance, a very slight alteration of the form of the land near Point Danger, in latitude 28° , would completely obliterate the line, and leave the observer in the same state of doubt as to its direction as when he comes to Wilson's Promontory, if he were guided solely by the delusive aspect of the levels, and did not well consider the sculptured form of the surface of the rocks, whether under or above the sea.

The line of the Cordillera, as we observe it on the map, has not always been preserved. It has been changed again and again. There have been many oscillations of the land; and where we see now lofty hills and grass-clad downs, there was once a stormy ocean casting into its depths the waste of mountains. The evidences of recent changes are easily obtained. The shell beds in the swamps and streams trending towards Port Phillip and Western Port show that large areas have been upraised very recently, and that the configuration of the land has been sensibly altered within quite recent periods.* No less conclusive are the proofs, afforded by the present and past

* It is not wise to attempt to form estimates of the duration of the periods within which elevatory action has prevailed, nor (with any degree of precision) to give an account of the changes which have been effected by such action. And yet persons unacquainted with geological phenomena are always enquiring as to the *time* which has elapsed since the several formations were upraised and became dry land. Geologists know that all such calculations are liable to so many errors as to be useless, and that all attempts to measure geological periods by *years* are futile.

But sometimes, by assuming a regular increase of elevation (where we know that the general tendency is towards elevation, but for what length of periods interrupted we know not) we may, to a certain extent, satisfy the curiosity of the enquirer.

If we assume that the land near Melbourne has been raised every year but one-sixteenth of an inch, a period of nearly 1,400 years has elapsed since the waves of the sea beat the basaltic cliffs near

condition of the Barrier Reef, on the north-eastern part of the island-continent, that the land towards the north is slowly sinking. Somewhere—probably at or near a point in latitude 30° —we shall discover the axis on which the mass of land turns, where, in relation to the sea-level, it is at rest.

Whether or not the watershed extending to Wilson's Promontory be the extension of the Cordillera, it is certain that a well-marked range extends from Cape York—the north-eastern extension of the island-continent—southwards to Wilson's Promontory, the most southern point of Australia, and that a chain of islands connects Australia with Tasmania, where, in continuation of this chain, there is also a well defined watershed extending southwards.

The Great Spur, from St. Clair westwards to the 145^{th} meridian, where occur basaltic and volcanic rocks, is composed of granites, palæozoic sandstones, mudstones and shales, and porphyritic rocks. Thence westwards it would probably be impossible to trace a continuous range if the quite recent basalts and volcanic lavas were removed. The palæozoic schists and the granites stand as islands in the basaltic tracts; and these tracts appear in some places as low, level, even plains, and in others as broken, disunited patches. In some parts the denuding forces have affected the volcanic rocks but slightly; but in places only a little removed from the level plains they are almost completely worn away, and the boundaries of the areas they once covered can scarcely be mapped out.

Partly intersected by, and east of, the 142^{nd} meridian lie masses of thick bedded sandstones, forming the Victoria, the Serra, and the Grampian ranges. They are probably of upper palæozoic age. Bold, abrupt cliffs of a somewhat peculiar character, due to the horizontality of the beds, give a marked character to the landscape; and the rather smooth outlines where the rocks have been worn away gradually in the trend of the streams present pictures which are delightful to the eye of the artist. The peaks of Mount William, on the edge of the palæozoic mass and abutting on granite, are as high as 5,000 and 6,000 feet, but in the Dundas Range, further westward, the hills are not higher than 1,524 feet.

Still further westwards there is a mass of granite lying in the midst of a large area of chloritic and micaceous schists, whose age is unknown. From thence westwards to the western boundary of the colony there are level tracts of tertiaries, with a solitary boss of granite west of the River Glenelg.

The Great Spur may be said to end in the Pyrenees Range, because the ranges and peaks lying to the west are unconnected with it, and as distinct from it as are the level tracts between the Glenelg and Lacepede Bay. Anyone who will take the trouble to examine the configuration of the country between the Pyrenees and the southern limits of Lake Alexandrina will, I believe, form the same conclusions; but it is right to say that some eminent men, well qualified to give an opinion on such a question, believe that the Main Spur is an extension of the Cordillera.

the race-course—since the swamps of Mordialloc and the low lands near the mouths of the Yarra and the Saltwater River were estuaries.

The Aborigines give vague accounts of great changes near the Bay, and it is well known that legends linger amongst peoples long after the facts which gave rise to them are undiscoverable.

Assuming the same rate of elevation, it is nearly 62,000 years since the sea receded from the mouth of the Campaspe at Echuca; yet with how many checks, during periods when the land was quiescent, or the action retrograde, we know not. Throughout the whole of this period the greater part of Victoria was habitable land, clothed with grass and trees as we see it now.

The physical character of the country within which the drainage is towards the River Murray is diversified. In its eastern and central parts it is mountainous, and towards the west low and level. The plains of Omeo, and the country near the sources of the Mitta-Mitta, are said to be more than 3,000 feet above the level of the sea; and the peaks in this elevated tract rise to a great height. The Gibbo Range, the Benambra Mountains, the Bogong and the Buffalo Mountains—spurs from the Cordillera, within whose recesses rise the Rivers Mitta-Mitta, the Ovens, and the Buckland—are, in some parts, from 5,000 to 6,000 feet in height. Beechworth, the principal town of the mining district, which is situate on small tributaries of the lower Ovens, is 1,750 feet above the sea. Granites, metamorphic rocks (whose connection with the silurian rocks is not yet established with certainty), and lower palæozoic rocks, occupy this elevated area. The streams in some places have cut very narrow and, for a considerable distance, straight channels, and the adjacent rocks form escarpments or steep slopes about 800 feet in height. Near the junction of some of the streams there is a narrow gorge, giving entrance to a level tract about 200 or 300 acres in extent, which is apparently encompassed on every side by very steep hills, from 800 to 1,000 feet in height; and in such a place a stranger finds some difficulty, at first, in determining the lines of watershed and the course of the main channels and tributaries.

The Mitta-Mitta* and the Kiewa Creek, at some distance from their sources in the Cordillera, take a northerly course to the Murray, and their numerous tributaries run eastwards and westwards, thus intersecting the rocks and veins, which have generally a meridional strike, at all angles.

The Ovens† has a northerly and north-westerly course, entering the Murray near Bundalong.

The Broken River has its sources in the Mount Battery or Beolite Range, which separates it from the River Delatite, a tributary of the Goulburn. It receives a large tributary, the Holland River, from the eastward, and the two unite at Benalla. Beyond Benalla, and within the area of the Murray tertiaries, the stream bifurcates, one channel, the Broken Creek, trending towards the Murray, and the other, the Broken River, entering the Goulburn near Shepparton.

The Goulburn,‡ which has its sources in the north-western parts of the great bend of the Cordillera, runs westerly to Seymour, where it turns to the north and enters the Murray about five and a-half miles east of Echuca. All the southern tributaries of the Goulburn, from the Jerusalem River to the 145th meridian, have generally a northerly direction; but its northern tributaries are so numerous and so complicated—presenting in one case within the level tertiary tract a remarkable bifurcation, one branch running to the Goulburn and another to the Murray, and so many intricate ranges—that it is impracticable to give an account of all of them.

The appearance of the country near the sources of the rivers is bold and imposing, and singularly rich in color, owing to the exposure at great heights of masses of weather-worn naked granite, and deep ravines filled with rich vegetation, and bold

* The area of the basin of the Mitta-Mitta River is about 2,000 square miles, and its length is said to be 100 miles.

† The Ovens River would be navigable for some distance from the Murray if the stream were cleared of dead wood and a few jutting rocks. The work would not be very expensive; and it will, no doubt, be hereafter accomplished with beneficial results, both to the miner and to the farmer.

‡ The estimated area of the country drained by the Goulburn is 6,700 square miles, and its length is about 200 miles. At little cost it could be made navigable for small steamers as far as Seymour. It receives many fine clear streams, and even as high as Alexandra is a river of no mean proportions for Australia.

hills everywhere, thickly covered with gums and scrubs. These, when the sunlight falls on them, contrast well with the dark forests beyond and the softened tints of the more distant ranges. The foregrounds, strictly in keeping, if not so rich in color, are exactly what a true artist would carefully study in their smallest details. The loose stones have come from the mountain masses beyond; the poor shrubs have their congeners in the distant valleys; and the very streams themselves owe something of their character to their far-off sources. These things, so long neglected, should be observed. They are worthy of the study of artists, and no conscientious landscape painter can neglect them.

In the higher parts of this district snow lies in the sheltered valleys during a great portion of the year; and in winter the labors of the miners are often interrupted, and their hardships not a little increased, by reason of the difficulty and danger of travelling, and the impossibility of conveying provisions and stores to the more elevated spots.

West of the Goulburn there are several ranges of considerable importance. One, composed of trap with fossiliferous upper silurian or lower Devonian rocks on its flanks, in the elsewhere rather flat county of Rodney, runs northward from Heathcote to the western marge of Lake Cooper; and from its culminating point—Mount Ida—there is a spur running north-easterly towards the Goulburn. Jay-jerk, or Mount Ida, rises to a height of 1,500 feet.

The Mount Alexander range extends from Wuid-kruirk, near Trentham, in a direction nearly due north, to Sandhurst, and has peaks more than 3,000 feet in height. For a distance of twenty-four miles from Wuid-kruirk (a peak of the Great Spur) the range is composed of silurian rocks, and for sixteen miles it is granite. On the northern marge of the granite, where these rocks abut on the silurian claystones, the range follows the boundary; but the main axis is traceable northwards through the Sandhurst goldfield up to the Murray tertiaries, where it is lost to view.

The mass of granite which forms part of this range is of the shape of a horse-shoe, one extremity touching Taradale, on the River Coliban, and the other Baringhup, on the River Loddon. The goldfields of Castlemaine lie in the inner space, and are almost encompassed by the granite; and the goldfields of Sandhurst stretch northwards from the outer bend.

The tributaries of the Campaspe and the Coliban are tortuous, winding through masses of schist and patches of basalt up to the point where the main streams form a junction. Beyond this point the stream is known as the Campaspe: it passes through silurian claystones as far as the junction of the Axe Creek, whence its course through the tertiaries, though it zigzags, is nearly due north to the Murray.

The sources of the River Loddon are in the Great Spur; its feeders run through an area which has been the scene of once active volcanoes; there has been much denudation, and the creeks are deflected; but beyond the point where all the principal tributaries unite, near Eddington, its course to the River Murray is nearly due north.

A mass of granite and the altered rocks on its boundaries, which lie to the west of the goldfields of Moliagul and Kingower, and run nearly north and south, form a range of considerable elevation. The space occupied by the granite is more than thirty miles in length, and about three or four miles in breadth. This range divides the waters of the Avoca from those of the River Loddon.

The Avoca has its sources in the Amphitheatre, a small patch of granite lying on the northern slopes of the Great Spur, and takes a zigzag course, but nearly north, towards the Murray. For seventy-five miles it runs through an area occupied by silurian claystones, and thence onwards through the Murray tertiaries.

The Avoca is divided from the Wimmera, the Avon, and the Richardson by a range of hills, which extends from the western rim of the Amphitheatre north-westerly to the watershed of the Avon.

The Avon and the Richardson run northwards to Lake Boloke, where their waters are lost by absorption and evaporation.

The tributaries of the River Wimmera drain a large area occupied by silurian claystones and granites, and partly the northern limits of the upper palæozoic patch. West of Glenorchy the river bifurcates, and the two streams run nearly parallel to one another. Near Wilson's station, one stream, called the Yarriambiack Creek, runs nearly due north to Lake Coorong (189 feet above the sea), where it is lost in the tertiary drifts; and the main stream—the Wimmera—after pursuing a westerly course for about twenty-four miles, runs also northwards. It discharges its waters first into Lake Hindmarsh, which is about twelve miles in length and four in breadth and 211 feet above the sea, and thence northwards, by an outlet creek, into a smaller lake—Albacutya—beyond which it is lost in the tertiary sands.

Near Mount Arapiles, west of the point where the Wimmera bends to the northward, there are numerous small salt and fresh water lakes and creeks. The Mount is composed of upper palæozoic rocks, and rises as an island in the midst of the level tertiaries. It is an outlier of the mass of the same age which forms the Grampian and Victoria Ranges.

In the extensive level area of tertiary sands within which the Wimmera and the Yarriambiack Creek trend towards the Murray, but stop short of it—the waters spreading over clay flats and swamps, and being lost by evaporation and absorption—the traveller, even with an accurate knowledge of the levels to guide him, would be unable, probably, to follow the ancient course of the streams with any degree of certainty. It is only when we carefully observe the vegetation that we can perceive distinctly the former geographical condition of the area. The Murray pine, in the midst of small eucalypti, such as the *E. Dumosa* and *E. Oleosa*, marks distinctly the lines of the ancient watercourses. The map showing the distribution of the forest trees of the colony, which has been recently prepared under my direction, and which displays in different colors the several kinds of timber, brings out boldly and clearly many phenomena which would necessarily escape the attention of even a trained explorer. The red dots, indicating the Murray pine, can be traced along the line of the old bed of the Wimmera, from Lake Hindmarsh to Albacutya, and from Albacutya to the River Murray; and in like manner it is easy to follow the course of the Yarriambiack Creek to its junction with the ancient extension of the Wimmera, by the narrow belt through the scrub, on which grow here and there small patches of pine. The beds of old lakes and tributary creeks can now be discovered in some places only by the timber which they bear.

The part of the colony just described, which lies to the north of the Cordillera and the Great Spur, is separated into two parts, in all their characteristics very distinct from one another. From the junction of the Blackdog Creek and the River Murray—a little to the west of the Wahgunyah goldfields—an irregular line, but in the main following a south-westerly course to the 141st meridian (near the River Glenelg), marks the southern boundary of the Murray tertiaries. All the country (in its widest part 230 miles from north to south) between this line and the River Murray is occupied by level tracts of sands and clays, not more than 200 or 350 feet above the level of the sea. South of the line above described, and between it and the dividing ranges, occur palæozoic rocks and granites, rising in many parts to a great height, but attaining

their greatest altitude towards the north-east. This arrangement gives rise to variations of climate which are not without their effect on the mean temperature and general climatological conditions of this part of Australia.

The country to the east is mountainous, with here and there majestic masses of granites and schists. The higher peaks and passes are covered throughout a great part of the year with snow, and are nearly always capped with clouds. Turbulent streams run through narrow gorges, and dense foliage extends from the flats to a height of nearly 3,000 feet. On the higher parts, where vegetation is nearly absent or poor and scanty, we find in the colder seasons but bare rocks, snow, and ice-bound streams, and in spring much that reminds the Victorian traveller of almost forgotten Alpine scenery. Towards the west and north-west the country is low and level, the streams are sluggish, the rainfall is uncertain and but small in amount,* the summer season is intensely hot, and the evaporation is ordinarily so much in excess of the natural supply from the heavens, that lakes and waterholes in many places present an appearance suggestive of great cyclical changes in the climate.

Even in the more favored districts within the area of the tertiaries the streams are feeble, and run only during the rainy season. A few waterholes and a zigzag line of broken ground mark the course of them. One may drive for miles across the country and meet with no insurmountable obstacle to the passage of a carriage. Further to the west, and still within the area of the Murray tertiaries, we come upon large tracts covered with mallee scrub. The underlying soils and sands are saliferous and gypsiferous, and water is difficult to find and not good in quality.

South of the boundary of the tertiaries, and between it and the Great Spur, the silurian and other palæozoic rocks are sculptured minutely by the denuding forces. A map on a small scale shows hills and ranges of such forms as almost to bewilder the observer; but, by a little attention and close observation, it is easy to trace the drainage areas, and to follow them up to the point where the main streams take their course to the north through the level country.

Throughout this area there have not been found any vestiges of the mesozoic (coal-bearing) rocks, which in the southern and south-western areas are conspicuous, and so situated as to suggest that they once covered a considerable part of the southern extremity of Australia; and, as far as is known at present, there are only two or three points within the tertiary tract where granite appears at the surface.†

About $144^{\circ} 40'$ we touch the horizon of the graptolite fauna. East of this line the rocks are marked by flora and fauna restricted to the upper silurian and upper and middle palæozoic rocks for some distance, but in the further eastern parts the graptolite slates again appear.

* When I was Director of Meteorological Observatories in Victoria, I initiated a system, which, if it had been pursued, would have given the public information as to the mean temperature, the mean degree of humidity, the rainfall, the evaporation, and the mean height of the barometer for all the inhabited parts of the colony, and without much cost to the Government. Numerous able and competent observers were ready to give their services gratuitously.

† The localities where the granite rocks are found are Mount Hope and Pyramid Hill, west of Echuca; and there is also a small patch west of the Glenelg. This large area has been but imperfectly explored, and it is probable, when it is thoroughly prospected, that numerous patches of granite and schist, islanded in tertiaries, will be discovered throughout. I have been informed lately that there is a patch of syenitic granite west of Inglewood; but I have not yet received any specimens from the locality.

That part of the Victorian territory which lies to the south of the Great Spur has a better climate than that of the northern area, and its soils are as rich as could be desired. The area of its water surfaces, as compared with other parts of the colony, is considerable, and the numerous bays, lakes, and streams increase the humidity of the atmosphere to an appreciable extent. Both in the high lands at the sources of the River Yarra, and on the plains in the Lake District, the character of the vegetation is altogether different when we approach the well watered parts. Where the soils are deep and rich, and the rainfall is generally heavy and the climate is moist, we find trees as large as any in the world. In the deep recesses of the mountains, near the sources of the Yarra, the mountain ash (*Fagus Cunninghami*) attains a height of 300 feet, and the *Eucalyptus Amygdalina* quite 400 feet; and all around is covered with a dense undergrowth of tree ferns and shrubs which overshadow streams that never, even in the driest season, cease to flow.

Leaving the hot and sultry streets and suburbs of Melbourne in the midst of summer, when the air is like the blast from a furnace and the ground is baked or beaten into dust, we can in a few hours reach a tract which is always green, always moist, and where bubbling streams, fed by mountain springs, flow with noise and sparkles over pebbly beds to the main river—where the rich green of the fern leaves and fronds mixes in delicate harmony with the less brilliant tints of the sassafras and the musk—and where steep and lofty mountains, even in mid-day, cease not to cast their shadows over the clefts whence the waters take their rise.

On the plains in the Western District we no sooner approach a lake than we observe that the grass is greener, and the foliage of the blackwood (*Acacia melanoxylon*) brighter and fresher than on the drier uplands.

The basin of the River Yarra has an area of about 1,500 square miles. Its eastern sources are in the Cordillera. On the north its basin is bounded by the Great Spur, and on the south by a chain of considerable elevation, extending from Mount Baw-Baw on the east to Coranworabul on the west. Its southern tributaries drain an area occupied by granite, and on the north and on the south there are two large patches of porphyry (forming respectively the Mount Juliet and the Coranworabul ranges); but its basin is composed mostly of upper silurian or lower Devonian rocks. West of the Diamond Creek, and to the north of the river, there occur small patches of (apparently lower) volcanic rocks. The River Plenty, an important tributary of the Yarra, runs southward from the Great Spur, and unites with the main stream near Eltham. It cuts through palæozoic rocks throughout the greater part of its course; but south of Yan Yean it intersects the newer basaltic rocks, which extend thence westwards, with few and unimportant breaks, to the River Glenelg, on the western confines of the colony, a distance of 224 miles. A little north-west of Morang, a very small patch of older basalt is seen in the centre of a little island of palæozoic strata, which is surrounded on every side by the newer volcanic rocks.

The course of the Merri Creek, from the Great Spur to its junction with the Yarra, is nearly wholly through volcanic rocks, and many instructive sections are exhibited in places where it has cut a deep channel. The Moonee-Moonee Ponds, which have their sources in a patch of granite north of Broadmeadows, intersect palæozoic rocks which are everywhere highly fossiliferous, and show in many parts ripple-marked sandstones with rain drops and worm tracks.

The Marybyrnong or Saltwater River, which rises in the Macedon Ranges, has cut a narrow course through the basalt; but the valley is deeply eroded in many parts; and, consequently, we see exposed for great lengths along its course the underlying silurian strata.



From a photograph by R. Daintree.

DRYDEN'S ROCK, MOUNT MACEDON.

Here also we find many highly interesting sections, more particularly in those parts where the river bends sharply. In such places we can easily trace the ancient course. Small outliers of basaltic rock, conforming in height, structure, and mineralogical character with the great mass which the stream has cut through, are standing now in such forms as to suggest that they were once points of eruption; but an examination shows their true character, and, where there is a horse-shoe bend, one can trace the shifting course from the brow of the basaltic plain, and along the line of the promontory, quite into the bed of the stream, and measure by feet and inches the extent of the erosion in past times.

The Marybyrnong River unites with the River Yarra near Footscray. Between Footscray and Flemington and the Bay there are large swamps, whose beds are formed of dark-blue and white clays and recent shells.

These estuary beds are traceable up the streams some four or five miles from the sea, and it is not difficult to show what were the boundaries of the ocean in past times, nor to point to the cliffs which within quite a recent (geological) period were beaten by surf. A very slight depression of the land near Melbourne would serve to separate the Yarra from the Marybyrnong, and cause these streams to flow in their ancient channels. Perhaps no part of the colony is more interesting to the geologist than the small area lying within the boundaries of the boroughs adjacent to Melbourne.

If the post-pliocene area suggests important changes in the geographical features, how much more might be gathered relative to the past condition of the lands lying near Hobson's Bay, if we could separate and accurately delineate on a map the boundary lines of the older tertiaries, large patches and outliers of which are found on all the neighbouring hills. But this is a work which needs the whole time of an industrious life, and here, as at home, we must wait patiently for results. Enough has been done by the geological surveyors for present purposes; but until a thorough examination is made of the flora and fauna which are found in these strata, it is impracticable to place all the rocks in their true sequence.

The Kororoit Creek, which enters the Bay near Williamstown, drains an area which is nearly altogether basaltic. Only in its upper part is the palæozoic rock exposed.

The course of the Skeleton Creek is wholly through basalt up to a point near the sea where its waters spread over flats occupied by thin beds of sand and mud of post-pliocene age. The River Werribee has its sources in the Great Spur. Its upper tributaries drain a large tract occupied by lower palæozoic rocks, and steep cliffs and bold escarpments are found there. South of Mount Blackwood there is a small patch of granite surrounded by newer volcanic rocks, and west of the Korkuperrimul Creek an area occupied by older basalt. The Pentland Hills, and some small tracts adjacent to them, are composed of what are supposed to be newer palæozoic rocks.*

The course of the Little River is principally through the newer basalts. The Anakies and the Youda Yowang or Station Peak ranges, near its western source, are composed of granite.

* Mr. Daintree believes that these rocks are of mesozoic age. I have examined them, and I agree with him. The fossil plants which I collected appeared to me to have closer affinities with the flora of the mesozoic period than with the fossils of the upper palæozoic beds. Mr. Selwyn justly observes that, in cases where the beds are intermediate and probably mark the passage from the upper palæozoic to the lower mesozoic, it is proper to attach some weight to the lithological character of the rocks. He has shown due caution in the description of these beds, both in his maps and reports; and subsequent discoveries may prove that he has accurately described them.

The course of the Duck Ponds intersects a narrow strip of limestone (in the line of the bed of the stream), where occur bone-caves.

There is a rather intricate system of drainage north-west and west of Geelong. The River Moorabool, which receives the waters of Lal-Lal and Five-mile Creek, unites with the River Barwon near Fyansford, and disembogues in Lake Connemara (connected by a narrow strait with the Sea). The River Leigh, which, like the Moorabool, has its sources in the Main Spur, unites with the Barwon near Inverleigh, and the Barwon has its principal sources in the ranges lying about seven miles north of the coast, and extending from Apollo Bay to Cape Patton; and its western tributary, the Birregurra Creek, rises in the low range east of Lake Colac. The country drained by these rivers and creeks is extensive and diversified in its character. Sutherland's Creek, an eastern affluent to the Moorabool, has its sources in an exposed area of palæozoic rocks, intersected by numerous veins of quartz, wherein lies the Steiglitz goldfield. The Moorabool in its upper parts runs through silurian strata, which are auriferous, but lower down it takes its course through the newer basalts.

On the sources of the River Leigh or Yarrowee are situate the goldfields of Ballarat. On one side of the stream for some distance there is basalt, and on the other palæozoic claystones and sandstones. A little below its junction with Williamson's Creek it enters the newer volcanic tract which extends southwards to Inverleigh (the junction with the Barwon), and thence nearly to the boundary line of the mesozoic rocks, from which it is separated by only a thin strip of miocene tertiaries. About six miles south of the point where Williamson's Creek unites with the Yarrowee, the river cuts through and exposes a very small area of granite.

The Barwon drains part of the area occupied by the mesozoic and miocene strata; and the course of the Birregurra Creek is mainly through miocene strata, but in its upper part it cuts the newer volcanic rocks.

West of the tributaries of the Barwon lies the lake district, which presents by far the most interesting physical features in Victoria.

Lake Korangamite, the centre of the great depression (345·95 feet above high-water mark of Corio Bay), is about twenty miles in length from north to south, and in some places seven miles in breadth. In ordinary seasons it receives the drainage of 1,144 square miles of country, and in very wet seasons it is connected with numerous lakes on the west and on the east. Its most northern feeder has its sources in a swamp within a short distance of Lake Burrambeet, which is 1,286 feet above the level of the sea; and it receives the waters of the Pirron Yaloak Creek on the south.

It is separated from a smaller lake—Gnarput—by a neck of land only a few chains in width, and Gnarput has four feeders coming from the north. The waters of the lakes are salt, and they may be considered as inland seas on a very small scale. The northern feeders of Korangamite cut through palæozoic rocks, which are everywhere auriferous; but the greater part of the large area draining into the lake is composed of newer volcanic rocks, under which, in many places, very profitable leads of gold have been wrought.

The existing drainage area, 1,144 square miles, is large; but there is reason to believe, from what has been discovered at Smythesdale, that numerous channels, sculptured in the palæozoic rocks, will be found to trend towards this great depression; and that when, by the labors of the miner, the under surface is fully explored, the ancient drainage area will exceed that which now appears on the surface. In what manner it may be modified is, however, uncertain; but that it deserves close investigation is beyond doubt, because rich leads of gold trend towards it.

The Emu Creek and the River Hopkins drain an extensive tract of volcanic country. The Emu Creek has its sources in the Great Spur, between Raglan and Burrambeet, and some parts of its northern tributaries are auriferous. It receives the overflow of the White Stone Lagoon and the waters of the Trewallo Creek (Raglan goldfields), and takes a course through the newer basalts to Panmure, a little west of which it forms a junction with the Hopkins.

The Fiery Creek, on the tributaries of which the Raglan goldfield is situate, disembogues in Lake Boloke—connected in wet seasons with the Salt Creek—which joins the Hopkins south of Hexham.

The Hopkins at its source is fed by creeks whose beds are auriferous. The Ararat gold drifts lying to the south of the Main Spur and the adjacent deep leads which trend under the basalt belong to this system of drainage. West of Lake Boloke, and intersected by the Hopkins, there is an island of lower palæozoic rocks, in the midst of the newer volcanic tract, which measures from north to south about twenty-eight miles, and from east to west about twelve miles. A narrow line of porphyry and numerous dykes cut through the palæozoic mass. Towards the southern point a patch of sandstone strata crops out, which is supposed to be of upper palæozoic age. In passing through this country enquiries were made as to its character and as to the results obtained by prospectors who had sunk shafts in the alluviums overlying the lower palæozoic rocks, but nothing certain could be ascertained as to the yield.

The Rivers Merri, the Moyne, the Shaw, and the Eumeralla drain part of the area occupied by the newer basalts and volcanic rocks.

The River Glenelg and its tributary the river Wannon drain a large area composed of thick-bedded sandstones of upper palæozoic age, a large tract occupied by chloritic and micaceous schists, granite, porphyry, mesozoic (coal-bearing) rocks, and miocene and pliocene tertiaries.

The south-western area of the colony, whether as regards its systems of drainage, its numerous cones and peaks—once points of eruption—its vast sheets of lava, its numerous swamps and accompanying rocky prominences, the large tracts occupied by coal-bearing rocks, the great development along the margin of the coast of strata of miocene age, and the numerous deep leads trending from the Great Spur towards the volcanic centres, is perhaps more interesting to the miner and the geologist than any other portion of the colony.

Throughout the whole extent of the volcanic area there are, at short distances apart, peaks and crateriform hills, and lakes of fresh and brackish and salt water. Near the bases of some of the mammiform hills there are numerous small craters, some of them dry and covered with grass, and with lightwood trees growing quite low down on the steep sides of the circular cavities; and others are nearly full of water.

Bulleen-Merri and Gnotuk, two lakes situate near Mount Leura,* are separated by a narrow ridge composed partly of fossiliferous miocene tertiaries and partly of volcanic rocks. Bulleen-Merri, the larger lake, is brackish and pretty deep; and, having a drainage area sufficient to supply enough fresh water to keep the level of the lake very close to the mean height, is well stocked with small fish and mollusca.

* In a well sunk at the base of Mount Leura the workmen cut through three and a-half feet of good soil, and twenty-five feet of alternating layers of mud and ashes (including small fragments of scoria, lapilli, and other ejectamenta), which were nearly white, grey, and black, and from a quarter of an inch to three inches in thickness. The bottom was a hard dense basalt, with crystals of olivine.

Gnotuk, the waters of which are about 130 feet below the level of Bulleen-Merri, is bitterly salt. The drainage area is small, and it receives but little rain water, and is only slightly fed by a spring issuing from the sloping bank which divides it from its neighbour. Even here we find fish and a few brackish-water shells.

Dead trees stand in the water near the margin of the lake, and the soft mud is full of the bones of animals which have perished on its shore. It is a sad and solitary spot. Steep banks surround it, sombre gum trees give a cold coloring to its margin—but slightly relieved here and there by the brighter tints of the lightwood—carrion birds wheel over its still waters, and the whole has a weird aspect, but is yet full of beauty; a picture which the conventional artist would disregard, but one which the trained student would study with delight and profit. Coccolite and fragments of topazes are strewn along the shore in many places.

Near Tower Hill, which is situate in the midst of a lake, there are recent beds of volcanic ash. The water of the lake is about twenty-five feet above the level of the sea, and a large tract of swampy land extends from the lake to the sea-coast. The average slope of the hills is about 6° ; and the inner slope, which forms the margin of the lake, is about 30° . The island is irregular in outline, and shows numerous peaks and extinct craters.

Mr. H. Cadogan Campbell, when he was stationed at Warrnambool, had an opportunity of observing the strata sunk through in a well on the south-eastern slope of the margin of the lake:—"They sank first through about three feet of soil, and then for about sixty feet passed through layers of ash, alternately black and white, and of irregular thickness, though none above an inch or two. At the depth of sixty-three feet the workmen came upon the original surface of the ground, which was covered with the common coarse grass now found growing. It was not scorched, but merely dry like hay."*

Underneath the ancient grass-clad surface the workmen sank sixty feet through a blue and yellow clay. It was in sinking this well that the skull and some other bones of the dingo, or wild dog, were found, being the first decisive proof that this animal is indigenous. The bones were presented to the National Museum, where they are, no doubt, carefully preserved by the energetic director, Professor McCoy. Having carefully examined the several layers of volcanic ash at Tower Hill, I am able to state that Mr. Cadogan Campbell's description is very accurate. In many parts the cliffs are somewhat worn, and show clearly the thin strata of dark and light colored ashes which make up the great mass. I saw no fragments bearing the impress of leaves or cones; but a more extended exploration would probably bring to light rich materials for the palæontologist.

Tower Hill is undoubtedly one of the most recent of the once active points; and though it is probable that its pillar of fire and its dome of ashes were raised for the last time long before the peoples of Europe were lifted out of the state of barbarism, it is far from certain that this volcano was not a beacon to many wandering tribes of savages in far-off times. Without crediting the details of the legends of the aborigines, there is something in the structure of them which suggests that their authors were not wholly ignorant of some of the great changes which have left their marks on this part of the territory.

This is not the place to describe minutely the character of the country lying within the range of the more recent centres of volcanic action. Cones and crateriform

* Quarterly Journal of the Geological Society of London, 1857, p. 227.

hills are found from the 145th meridian to the western boundary of the colony ; and it is not difficult even now to trace the course of many of the once red and glowing streams of lava ; but this is a work for the geologist, and foreign to the simple purpose of this paper—the dissemination of facts likely to be useful to the miner.

The south-eastern division of the colony presents many features deserving of close investigation. The little that is known respecting its goldfields, copper mines, tin mines, its veins of galena, and its coal deposits, serves to stimulate enquiry ; and the richness of its soils and the salubrity of its climate render it specially attractive to the settler. All of it has not been fully explored, and every day brings to light new facts relative to its rock formations and the minerals and metals which are found in them.

The Genoa River drains an area of granitic country where occur numerous dykes of diorite. About four miles above the head of Mallacoota Inlet, into which it flows, it enters a tract of palæozoic country which extends from the north-eastern boundary of the colony to Ram Head on the coast. This tract is covered in many parts with auriferous alluviums, but it is badly watered.

The basins of the Toolaway River, with its tributaries the Tarra and Drummer, and the Cann or Tamboon, are composed of silurian rocks with auriferous alluviums, and the area is well watered.

The Brodribb River flows southwards from the ranges which divide its waters from those of the Delegete. The dividing ranges are sinuous, and in one part N-shaped, one source of the Delegete being far south of the main source of the Brodribb. The course of the Brodribb is through palæozoic strata, but its tributaries have scooped valleys deep enough to expose the underlying granite. Near its embouchure it cuts through a small patch of granite.

The Snowy River, which crosses the boundary of this colony about thirteen miles south-east of Forest Hill, drains an area of 5,000 square miles, the greater part of which is situate within the New South Wales territory.* Its main western tributary, the Buchan River, enters the Snowy River near Buchan, and is wholly within the Victorian boundaries. Its eastern tributaries, the Tellicura, the Dingaringa, the Deduc or Jingalala—all of which unite in one main stream—join the Snowy River some six miles south of the Bulla-Bulla Mountains. The Bendoc and Delegete have their sources within the Victorian territory, but flow northwards and unite with the Snowy River about six miles above the Great Bend at Quedong, where veins of copper are found.

Below the point where the Snowy River enters Victoria there are many small tributary streams running into it from the westward ; but as the main stream flows southwards parallel to, and no great distance from, a spur which runs southwards from the Cordillera, these streams have small drainage areas, and do not call for lengthened descriptions.

* The Snowy River is often flooded ; during heavy rains the waters rise rapidly, sometimes at the rate of one foot in an hour. Captain Cadell informs me that, during a great storm, when much rain fell, and when a strong gale blew from the south-west, making a heavy and high sea at the mouth, the river cut a new channel through the sand dunes, about five miles westward of the old mouth, and continued to flow through it for some time. The new channel gradually silted up, and the river again took its accustomed course, but not until after the lapse of a considerable period, nor without effecting important changes in the form of the land near its embouchure. If there were a better entrance, and if the river were cleared of snags, the stream would be navigable for a great distance inland. When the quartz veins and the alluviums in the north-eastern tract are properly opened up, this river will become of great importance, and not one or two, but quite a fleet of steam-boats will be seen on it.

The course of the Snowy River, from the north-eastern boundary of the colony to a point about five miles below Buchan, intersects an area of porphyritic rocks, which is sixty miles in length and about twenty-five miles in breadth. Within this tract occur large patches of hard dark-blue limestone* and small outliers of upper volcanic rock. The valleys of the Bendoc and its tributaries, and those of the Dedoc and its tributaries, expose narrow tracts of granite. The adjacent rocks are lower silurian, with here and there dark shales with graptolites, and in other parts hard, nearly vertical metamorphosed slates and sandstones. There are numerous veins in the silurian tracts containing pyrites, galena, and gold. Auriferous alluviums have been wrought for a long period, and they have lately attracted much attention.

* It is commonly supposed that the rocks of the colony are deficient in lime, and for a long period I was of this opinion; but when we observe more carefully the constituents of the rocks which are most generally distributed, and which occupy the greatest areas, there is reason to modify former conclusions. The basalts contain from five to fifteen per cent. of lime; and, though strata composed wholly of carbonate of lime are rare in the silurian formation, there is a good deal of lime in some of the fossiliferous layers. The marine tertiary limestones occupy extensive tracts on the coast; and in many parts, inland, we find lacustrine deposits which yield lime for the kilns. The following analyses of our limestones have been made by the Government Analyst, and are extracted from the work, by Messrs. Selwyn and Ulrich, *On the Physical Geography, Geology, and Mineralogy of Victoria*:—

"1. Limestone from near Keilor (geological survey map, 1 N.W.), composed of tertiary (miocene) fossils, colour yellow, soft:—Carbonate of lime, 91·61; carbonate of magnesia, 0·20; peroxide of iron, 2·53; silica and clay, 5·66 = 100·00. (This limestone, when burnt, yields good building lime.)

"2. Limestone from cliffs, Curdie's Inlet, white granular powdery rock (miocene tertiary):—Carbonate of lime, 84·438; sesqui-oxide of iron, 2·93; soda (carbonate), 1·74; alumina 1·13; water, 1·518; silica and silicate of alumina, 7·325; phosphoric acid and magnesia, trace = 99·081.

"3. Siliceous limestone, Fenwick's Gully, Queenscliff-road (miocene tertiary):—Carbonate of lime, 75·20; carbonate of magnesia, 3·00; silica, 15·79; alumina and peroxide of iron, 3·00 = 96·99.

"4. Yellow limestone, from Barwon Heads:—Carbonate of lime, 63·18; carbonate of magnesia, 0·36; carbonate of iron, 2·01; peroxide of iron, 8·33; silica and clay, 27·91 = 101·79.

"5. Septarian limestone, Schnapper Point (eocene tertiary):—Carbonate of lime, 82·012; carbonate of magnesia, 1·506; carbonate of iron, 3·472; clay and sand, 10·427; soluble silica, 0·720; water, 1·809; organic matter and loss, 0·054 = 100·00.

"6. Freshwater limestone, Coliban River, four miles from Kyneton, colour dirty white, dense, fracture uneven:—Carbonate of lime, 89·33; carbonate of magnesia, 7·45; carbonate of iron, trace; silica and clay, 3·22 = 100·00. (This limestone, when burnt, yields good building lime.)

"7. Limestone from the Duck Ponds (tertiary):—Carbonate of lime, 88·38; carbonate of magnesia, 0·76; carbonate of iron, 0·51; silica and clay, 7·02 = 96·67.

"8. Limestone, from Galena Point, Geelong:—Carbonate of lime, 89·50; carbonate of magnesia, 0·43; carbonate of iron, 0·72; silica and clay, 6·84 = 97·49.

"9. Freshwater limestone, from Lake Boloke (tertiary):—Carbonate of lime, 42·23; carbonate of magnesia, 2·18; carbonate of iron, 0·96; silica, 30·21; silicates of alumina, lime, and magnesia, 16·03; water, 4·46 = 96·07.

"10. Blue limestone, from near Buchan, Gippsland (upper palaeozoic?):—Carbonate of lime, 87·72; carbonate of magnesia, 0·23; carbonate of iron, 2·29; silica and clay, 7·61 = 97·85.

"11. Marble from a cave in the parish of Yering, on the Upper Yarra (upper silurian):—Carbonate of lime, 92·60; carbonate of magnesia, 0·36; carbonate of iron, 2·12; carbonate of manganese, 0·48; silica and clay, 3·24 = 98·80.

"12. White limestone, from near Mansfield:—Carbonate of lime, 54·70; clay, 43·30; soluble silica, 2·00 = 100·00."

Along the coast, which runs from south-west to north-east, and is exposed to the heavy seas brought up by south-westerly gales, there are numerous lakes. Nearly all the streams which flow from the Cordillera southwards enter the sea at a considerable distance eastward of the point where, if they continued their course, they would disembogue; and long narrow lakes, lying parallel to and only separated from the sea-shore by low sand dunes, receive their waters.

Within the area of the younger tertiaries, which extends from Ram Head to Corner Inlet, there are larger lakes lying further from the coast, such as Lake King, Lake Victoria, and Lake Wellington; but the main feature of this low coast-line is the narrow strip of heath-covered sand separating the lower parts of the streams from the sea.

The River Tambo rises in the southern slopes of the Cordillera near Mount Tambo, and it disembogues in Lake King, which is connected with the chain of lakes extending along the coast. At its sources are found granite, limestone, a patch of upper palæozoic rock, a tract occupied by lower silurians, a range of porphyry, and a considerable belt of metamorphic slates lying to the east and west. Its course is mainly through granite, metamorphic slate, and lower palæozoic rocks. In its western tributaries, which flow over lower palæozoic rocks, gold drifts have been found and wrought. The Haunted Stream—which, in its lower part, runs through granite—the Shady Creek, and the Monkey Creek, contain auriferous alluviums; but it is believed they are not very rich. Little is known respecting the character of the veins which occur within this drainage area.

The River Nicholson has its course mostly through silurian rocks, and the shallow alluviums in its upper parts are auriferous.

The River Mitchell, which rises in the southern slopes of the Cordillera, and disembogues in Lake King, has a large basin. It is fed by the Wonnangatta, the Humffray, the Moroka, the Wongungarra, the Crooked River, the Dargo, and the Wentworth, and by a great number of smaller streams, the tributaries of these rivers. When the volume of water is increased by the melting of snows on the Alps, the river is of large proportions for some distance upward from its embouchure. This magnificent stream drains a basin which is occupied throughout its extent by silurian rocks. Only three small patches of granite are observed—one at Budgee-Budgee, one at Quack-mungee Hill, and one at Mount Taylor. The sedimentary strata are intersected by auriferous quartz veins, many of them of surpassing richness, and the gold is found in all the alluviums lying in the beds of its tributaries. The quantities of fine gold carried down to the sea by this river must be very great. This country was opened up by Mr. Alfred Howitt in the year 1860. He was chosen from amongst a great number of applicants for the post of leader of a prospecting party, and it was whilst he was acting under the instructions of the Prospecting Board that he made those discoveries which have resulted in the profitable settlement of this part of the territory. He commenced his explorations on the 5th June, 1860, and on the 17th June he found gold in the Wentworth. Gold was found also about the same time in the Quackmungee Creek. Towards the end of June he ascended Mount Birregun, the height of which is about 4,500 feet; and early in July he got gold near Mount Pyke. Subsequently he prospected the Dargo and the Upper Mitchell, and finally discovered the rich reefs at the Crooked River. The results of his labors were not confined merely to the discovery of gold in a few places; he was the first to clear the way for explorers, to mark out tracks, to note guiding points, and to show at what a small expense really

good work can be done if the leader is zealous, intelligent, and faithful in the discharge of his duties.

The expectations entertained by the Prospecting Board and made known in their Report, which was presented to Parliament in November, 1860, have been more than fulfilled; and though many difficulties stand in the way of a complete examination by the miner of this part of Gippsland, it is fair to assume that he will surmount them, and that other new and valuable goldfields will yet be discovered.

Tom's Creek, which enters Lake Victoria, drains an area occupied by newer tertiaries.

The Perry River and the River Avon, which enter Lake Wellington, have their sources in a tract of upper palæozoic country which lies between the Mitchell and Macalister, and which measures about thirty-five miles from north to south, and about forty miles from east to west. The rocks are composed of grey and red micaceous shales, blue and red and purple shales, and brown and white sandstones, with fossil plants, and here and there stains of carbonate of copper. Some of the hills in this area rise to the height of nearly 5,000 feet, and the vertical extent of sedimentary rocks removed by denudation is enormous. The Perry and the Avon, in their lower parts, intersect the great belt of recent tertiaries.

The River La Trobe has its sources in the great bend of the Cordillera. Its largest tributaries are the Macalister, which rises near Mount Ligar, the Aberfeldy, and the Thomson. Numerous creeks, which take their rise in the eastern slopes of the Great Range, discharge a large quantity of water into the main stream during the rainy season, and even in summer some of them are beautiful streams. Shaded by lofty trees, and falling over ledges of broken rock, and in the narrow bends almost hidden by tangled masses of shrubs, creepers, and ferns; frequented by birds of exquisite plumage, and during the noon of the hottest day affording delicious shade and retirement, they would tempt the prospector to linger on their green banks even if there were not gold and gem-stones and rich ores to be got in the sands and gravels which form their beds.

The upper parts of the basins of the Macalister the Aberfeldy and the Thomson are occupied by lower silurian rocks. Rich alluviums have been discovered over an immense area; and at Stringer's Creek, Donnelly's Creek, and other places, there are auriferous quartz reefs. Diorite veins, with copper ores and native copper, occur near the junction of Cooper's Creek and the River Thomson, and at the same place, I have ascertained from Mr. John Ferres, there occur beds of fossiliferous limestone.

Within the watershed of the La Trobe there is a mass of granite culminating in Mount Baw-Baw; south of the Big Hill a large patch of older basalt; and still further south a large area occupied by mesozoic rocks, with seams of coal and carbonaceous shales, containing numerous fossil plants.

If the bed of the La Trobe were cleared of snags it would be navigable for small steamers for a considerable distance.

The small streams which have their sources in Hoddle's Range and fall into Corner Inlet are partly within the schistose area, and some of them are auriferous. The quartz veins which occur here differ somewhat from those in other parts of Gippsland. The quartz is brown, and more resembles chalcedony and hornstone than crystalline quartz. It usually presents a smooth surface, and in places breaks with a splintery and semi-conchoidal fracture. It contains gold, and has been crushed, but not, up to the present time, with profitable results.

The mineral wealth of Gippsland, its fine climate, and good soils, are beginning to attract attention. Its lofty mountain ranges, with their deep sheltered valleys, will sustain a hardy population, fitted to bear the severities of the winters of this region; and the rich lowlands in the valley of the La Trobe will nourish an industrious and probably less enterprising, but not less useful, class that will find in agriculture and horticulture mines of wealth scarcely less attractive than those which will be opened in the mountains.

The watercourses in Gippsland have scooped out deep valleys. The lofty hills have not been upheaved in isolated masses, but are the remains of formations which have been swept away by the slow action of water. The sea and the rain have done their work during countless ages, and we can only conjecture rudely, by observing the remains of strata once prevalent over large areas, what has been the condition of the country originally, and what has occurred in periods when the denuding forces were most energetic and when they were relatively quiescent.

If all the rock formations could be restored and placed in the positions which they once occupied, Gippsland would be an immense, nearly level plateau. As a familiar illustration, we may liken the mountains formed of palæozoic rocks to the humps of earth left by the navvy when he digs a cutting. The grass on the surface of the humps shows what was once the height of the ground which has been removed; and the recent tertiary formations on the tops of the hills in Gippsland are evidence of the original height of the whole area. The rocks which once occupied the intervening spaces have been eroded by water; and the height of the hills above the valleys affords some hint as to the vertical extent which has been cut away.

Looking at the country as a whole, and without regard to the geographical divisions, three areas present themselves for observation which differ very much from each other. The first, extending from the north-eastern boundary of the colony to the Grampians, and lying between the parallels of 36° and 38° S. latitude, is composed of upper and lower silurian rocks, with veins of auriferous quartz. The second is the vast extent of recent tertiaries lying within the basin of the River Murray, and extending from Wahgunyah to the 141st meridian, and including the tract on the southern side of the Cordillera, stretching from Ram Head to the sources of the La Trobe; and the third is the great area of recent basalts and volcanic rocks, with many extinct craters, reaching westwards from the 145th to the 141st meridian, and touching the sea-coast on the south and the junction of Axe Creek and the Campaspe River on the north.

These areas differ both as regards the climate and the soils. The greater part of the first is at a considerable elevation above the sea, and is tolerably well watered; and, influenced by the rain and the soils, we have timber trees which mark the boundaries of the rock formations almost as clearly as the geologist could define them. The map which has lately been prepared for the Board appointed to report on the best means of preserving the timber in the State forests shows that, within the area occupied by palæozoic rocks, stringybark, box, and messmate predominate; in the basin of the Murray, where sandy and calcareous tertiaries occur, the mallee scrub (*Eucalyptus Dumosa* and *E. Oleosa*) covers vast tracts, with but few intervening belts and clumps of pines (always growing on or near modern or ancient water-courses or lakes); and the basaltic plains are almost bare, showing only here and there a few small lightwood trees. The rivers generally are bordered by gums.

The approximate areas occupied by forest trees and scrubs in Victoria are estimated by the State Forest Commissioners as follows :—

	Square Miles.
Stringybark and messmate - - - - -	30,000
Mallee scrub - - - - -	14,000
Eucalypti of comparatively small dimensions, as box, yellow box, colonial apple-tree, peppermint, &c. - - -	14,000
Large white gums of various kinds (<i>Eucalyptus Amygdalina</i> , &c.) - - - - -	5,000
Red gum (<i>Eucalyptus Rostrata</i>) - - - - -	3,000
Lightwood - - - - -	1,000
Ironbark - - - - -	500
Oak, Murray pine - - - - -	500
Honeysuckle, wattle, and other low-sized trees not otherwise specified - - - - -	500
Sassafras, beech, and other umbrageous trees in sheltered mountain gullies - - - - -	300
Tea-tree scrub - - - - -	200
	69,000
Extent of open country - - - - -	17,831
Total area of the colony - - - - -	86,831

These figures were arrived at as carefully as, under the circumstances, was practicable; but since the map showing the vegetation of the colony was prepared some of the areas require to be re-computed. For instance, the country occupied by the mallee scrub is found to be not 14,000 square miles, but rather more than 18,000 square miles; and the area of open country, as corrected—13,831 square miles—is much nearer the area occupied by basalt. The other figures in the table are not very far from the truth.

Many of the trees mentioned in the above table are intermixed with those characteristic of the three areas, and though in the aggregate they may cover large areas, they do not appear as distinct features on the map. Many of the eucalypti of comparatively small dimensions grow in intermediate tracts, and mostly appear on and near the boundary line of the Murray tertiaries; but some of them are interspersed in localities where the prevailing timber is messmate and stringybark.

In the lofty ranges bordering the basin of the River Yarra, where rains are frequent, the climate moist, and the soils rich, there are very large trees.

Respecting the timber trees of this tract Dr. Ferdinand Von Mueller, the Government Botanist, thus writes :—"At the desire of the writer of these pages, Mr. D. Bogle measured a fallen tree of *Eucalyptus Amygdalina*, in the deep recesses of Dandenong, and obtained for it the length of 420 feet, with proportions of width, indicated in a design of a monumental structure placed in the Exhibition; while Mr. G. Klein took the measurement of a eucalyptus on the Black Spur, ten miles distant from Healesville, 480 feet high! Mr. E. B. Heyne obtained at Dandenong, as measurements of height of a tree of *Eucalyptus Amygdalina* :—Length of stem from the base to the first branch, 295 feet; diameter of the stem at the first branch, 4 feet; length of stem from first branch to where its top portion was broken off, 70 feet; diameter of the stem where broken off, 3 feet; total length of stem up to place of

fracture, 365 feet; girth of stem three feet from the surface, 41 feet. A still thicker tree measured, three feet from the base, 53 feet in circumference. Mr. George W. Robinson ascertained, in the back ranges of Berwick, the circumference of a tree of *Eucalyptus Amygdalina* to be 81 feet at a distance of four feet from the ground, and supposes this eucalypt, towards the sources of the Yarra and La Trobe Rivers, to attain a height of half a thousand feet. The same gentleman found *Fagus Cunninghami* to gain a height of 200 feet and a circumference of 23 feet. It is not at all likely that in these isolated enquiries chance has led to the really highest trees, which the most secluded and the least accessible spots may still conceal. It seems, however, almost beyond dispute that the trees of Australia rival in length, though evidently not in thickness, even the renowned forest giants of California, *Sequoia Wellingtonia*, the highest of which, as far as the writer is aware, rise in their favorite haunts at the Sierra Nevada to about 450 feet."*



FALLEN TREE, (*Eucalyptus Amygdalina*), Corapworabul Creek, Dandenong State Forest.

From a photograph by J. Noone, Esq.

Circumference one foot above ground	-	-	-	69 feet
Greatest height	-	-	-	330 "

In the places where these large trees grow the quantity of timber supported by the soil is also remarkable. In the State forest at Dandenong it was found by actual measurement that an acre of ground contained twenty large trees of an apparent average height of about 350 feet, and thirty-eight saplings of an apparent average height of fifty feet, the land being occupied besides by a dense undergrowth of large ferntrees, musk, dogwood, &c.

In one of the densest parts of the Mount Macedon State Forest, near Messrs. Carpenter's saw mills, an acre of messmate forest was found to contain forty-two large standing trees and twelve saplings. Many of the largest of these trees were from six to seven feet in diameter four feet from the ground, and from 200 to 220 feet high.†

* *Australian Vegetation*, by Dr. Ferdinand von Mueller, F.R.S., Director of the State Garden at Melbourne, 1867.

† *Report of State Forest Commissioners*, 1868. The measurements in the Mount Macedon State Forest were made by Captain Couchman, the Chief Mining Surveyor, and myself. In the Mount Juliet Ranges I found trees of far greater height, and standing much closer together, than in the Macedon Ranges.

In the ranges at Bullarook, in the triangular piece of country north of Cape Otway, and in the valley of Merriman's Creek, Gippsland, there are forests of great extent, where the timber trees are very high, and within a given space quite as numerous as in the State forests. *

It might appear from these statements that our forests are practically inexhaustible, and that any proposals for preserving timber and for planting conifers and other quick-growing trees in the State forests are premature. But, unfortunately, our position, as regards supplies of timber, is very bad indeed.

Our most considerable and most valuable forest tracts are at present unavailable, at any rate to the miner. Timber could not be brought, except at great cost, from the ranges of Dandenong or Mount Juliet, or from Gippsland, or from Cape Otway. The forests in the immediate vicinity of the more important gold-mining centres are almost exhausted; and unless the strongest measures be taken to preserve from waste what little timber is left, and to plant largely and judiciously, mining operations in many places will soon cease to be profitable.

Wherever the miners have pursued their labors the trees have been cut down; and we see acres of bare short stumps where a few years ago there was a stately growth of eucalypti.

There has been so much waste, and so much almost wanton destruction, that no time should be lost in repairing the damage, if indeed there is yet time to repair it with any hope of the new growth being available before some of the mines are abandoned. The general interests of the miners have been sacrificed to the greed or caprice of those who, until lately, ravaged the beautiful forests, as if the loftiest tree were the growth of a single night, and was placed there merely to be irreparably damaged or destroyed as soon as found. A giant of the forest has been killed in order to furnish a sheet of bark, and the smaller kinds have been burnt for the purpose of boiling a kettle.

The evil is one which does not readily force itself prominently before those who are most deeply interested. It progresses day by day; but so slowly that few take the measure of its rate of advancement.

Timber for the mines at Ballarat is now brought from Smythesdale; and in a few years (unless some change be made shortly) it will be impossible for the miner to pursue his labors even in many parts of the richest districts.

* Quite extensive tracts of forest lands have lately deteriorated by the decay of belts of trees. Numerous theories have been started to account for the destruction of the timber on these once flourishing areas. Many suppose that insects have attacked the tender buds, and destroyed them, or the roots, and prevented their growth. Others suggest that the extraordinary increase of the smaller marsupialia, now that their natural enemy, the dingo, is, in the inhabited parts, almost extinct, has caused the mischief. But, after examining many tracts where the trees have decayed, both in the level country and in the high lands, I am inclined to believe that, in most cases, the trees are killed by the changes effected on the surface by cattle and sheep which have been introduced by the settler. The tracks made by these animals carry off the rain water, and, where there is a slight incline, these tracks deepen into gullies, and drain the land so effectually as completely to destroy the conditions which, in the natural state of the ground, were favorable to the growth of the gums. In the camping places of the cattle you see many stately trees destroyed. The grass is beaten down and the soil broken, and the long roots of the trees exposed to the intense heat of the sun and to the frosts of winter. Where the roots are protected by litter or earth, the trees quickly recover, and spread their branches with a luxuriance not observable even in the natural forests.

The approximate cost of the props and cap-pieces, laths, slabs, sawn timber, and firewood used in the mines during the year 1867 was £561,123, and the importations from abroad of soft-wood timber, in deals and sawn stuff for building and other purposes, from the 1st January, 1852, to the 30th June, 1867, reached the enormous sum of £8,392,551. Surely these statements merit consideration. By a small timely outlay we could produce in our State forests soft-woods sufficient for all our wants. Nearly all the conifers grow very rapidly in Victoria; and perhaps it is correct to say that none of the more valuable timber trees of the world would fail to thrive in appropriate localities in our ranges.

It is commonly supposed that gold-producing countries are poor and barren, and that the outcropping bare rocks which usually appear in the vicinity of shallow alluviums are the only accompaniments of rich *placers*, and that the poverty of the soil is compensated for by the gold dust which sparkles in the sands of the streams. The miners of Victoria have shown the unsoundness of this long-established theory. Side by side with the gold miner we see the farmer busily ploughing rich chocolate soils which yield heavy and good crops. In the midst of a field of yellow corn there rise the engine-house and chimney which mark the spot where the miner has sunk a shaft for a deep *lead*; and on the slopes, falling towards the sites of puddling machines and sluicing operations, we behold rich vineyards and well stocked orchards. Near even some of the quartz workings there are gardens containing fruit-trees, which yield more to the cultivator than he could hope to gain in the same way in any other country; and scarcely a patch of land is too poor for the Chinese gardener. If he have water and a good market he will make the bare rocks grow green.

In order the better to estimate the extent of the actual and probable mineral resources of the colony, it is proper to give some account of the areas occupied by the more important rock formations. It is, unfortunately, not possible to give accurate data; but a statement sufficiently near the truth for practical purposes was given in the *Mining and Mineral Statistics of Victoria*, prepared by the writer of these pages, and published by the Commissioners of the Intercolonial Exhibition in 1866. That statement was based on a sketch-map prepared in 1858-9 from information obtained partly by personal observation, and partly from notes and sketches furnished by the mining surveyors and district surveyors of the colony, and a relatively small area was reduced from the maps on a scale of two inches to the mile, published by the director of the Geological Survey.*

From time to time the sketch-map has been amended, and quite lately the areas have been re-computed by Mr. Clement Johnstone, one of the officers of the Mining Department.

* In constructing this map I got much help from Mr. A. Skene, formerly district surveyor at Geelong, and now acting Surveyor-General in Melbourne. He has traversed nearly every part of the colony. Since the sketch-map was prepared, Mr. Selwyn, the Government Geologist, has published a geological sketch-map of the colony; and the latest amended map issued by him is the most valuable contribution to science which has emanated from his department. And it is not only valuable to the geologist, but a useful guide to the miner and prospector. With this map and the illustrative sketch-section in his hand, the geologist can find no difficulty in forming accurate conclusions respecting the main questions which present themselves for solution.

The results for the three natural divisions of the colony are as follows:—

	MURRAY DISTRICT.	WESTERN DISTRICT.	GIPPSLAND.	TOTAL.
	sq. miles.	sq. miles.	sq. miles.	sq. miles.
1. Granites and other plutonic rocks* - - -	1,000	700	500	2,200
2. Sandstones, claystones, mudstones; and metamorphic rocks and slates belonging to the lower silurian, upper silurian, and Devonian ages - - -	20,000	2,100	5,700	27,800
3. Carboniferous rocks, including schists likely to yield petroleum and rock soils, and excluding the older carbonaceous rocks† - - -	—	2,500	700	3,200
4. Basaltic and volcanic rocks‡ - - -	800	9,500	(?)	10,300
5. Tertiary rocks, excluding the thin alluviums, volcanic rocks, and gold drifts - - -	26,500	1,200	900	28,600
6. Limestones, of all ages - - -	50	30	250	330
7. Unexplored: much consisting of granites, and rocks belonging to the lower silurian age -	5,350	4,270	4,781	14,401
Totals - - -	53,700	20,300	12,831	86,831*

The total—86,831 square miles—is the area of the colony. One-third of the whole area may safely be assumed as occupied by gold-bearing rocks, all of which is easily available to the miner, and which he may prospect with reasonable hopes of success, and without running counter to any theory not already exploded. If we take into consideration probabilities, and regard the unexplored basaltic tract and the margin of the tertiaries as likely everywhere to be of the same character as the parts now being wrought, the estimate of one-third of the total area is much too low. And in the granitic areas, too, the miners find auriferous alluviums formed either of the detritus of silurian rocks carried down by streams having their sources beyond the boundaries of the granite, or of the remains of sedimentary strata which have been worn away, and which once reposed on the granite; and in some places the veins in the granite contain gold.

At several points the miners have followed the gold-yielding drifts into the Murray tertiaries. By and by these strata will be fully explored, and, if the leads be rich, a new set of conditions will have to be considered by those who have been accustomed only to the deep sinkings at Ballarat. Within the tertiary area we may expect to find many layers of washdirt, and the lowest will not always be the richest.

Some questions of moment present themselves when we explore the tracts occupied by upper palæozoic rocks. It is stated that in some of the tributaries of the Delatite—which run in channels formed of these rocks, and where occur fossil plants (including

* The area occupied by granites probably exceeds this estimate. There are patches of this rock exposed near Inglewood and Alexandra respecting the boundaries of which I know nothing. On the other hand, when the boundaries of the larger areas are accurately delineated, they may be found to be much smaller than at present is supposed.

† Contrary to custom, I have everywhere used the word *carboniferous* to designate these rocks, because these are the only coal-bearing strata in the colony. The word is usually applied to the older palæozoic coal-bearing rocks. The areas given in the table are probably under-estimated.

‡ This estimate has been made with great care. Large as the area is, it is certain that, when the whole of the colony is explored, it will be increased, but perhaps not to a great degree. There are small outliers of volcanic rocks in Gippsland.

the characteristic *Lepidodendron*)—and in the bed of Freestone Creek (traversing rocks of the same age), in Gippsland, gold has been found. Whether the metal is derived from the beds of coarse conglomerates which crop out in the cliffs forming the boundaries of the channels, or from veins in the adjacent silurian rocks, is not known. In one claim in Freestone Creek the miners, it is reported, washed $2\frac{1}{2}$ ozs. of coarse gold from a few dishes of stuff taken off the bed-rock. Some of the pieces weighed seven, eight, nine, and thirteen pennyweights, and there was but little fine gold.* Whether or not the silurian bed-rock is exposed in such places is uncertain as yet; but, whatever may be the conditions under which the gold is found, it is gratifying to know that the mere marking out of any area as occupied by these rocks is no sufficient reason for the assumption that it is non-auriferous. The newer palæozoic beds may include auriferous conglomerates, or, as they have been greatly denuded, they may be very thin; and the streams may have cut through them in some places (as in the gorges of the Werribee), and exposed the older rocks with their intersecting veins of auriferous quartz.

Having regard to the numerous different conditions under which gold-bearing drifts and auriferous veins have been formed, it is not easy to assign limits to the area within which the miner may prosecute his labors with reasonable prospects of success. The minimum is certainly not less than 20,000,000 acres; and as the miners during the past fifteen years have opened and explored not more than 600,000 acres, our gold-fields may be considered as practically inexhaustible. The time will come, in all probability, when labor will be cheaper, when young persons will be glad to get a fair remuneration for such work as they are fitted to undertake, and when even the excellent appliances now in use will be superseded by still more complete contrivances for reducing, washing, and otherwise treating auriferous earths; and veins and drifts which are too poor to repay the costs of reduction, as the art is now practised, will then be sought for with care, and dealt with intelligently, skilfully, and economically.

There is no necessity, however, for the miners of Victoria to waste their time in what might result, so far as their interests are concerned, in unprofitable investigations. Those amongst them who have formed domestic ties have settled permanently in the principal mining centres, where they can live comfortably, and where they can readily find employment at good wages, if they be not successful in discovering gold in their own claims. So many rich goldfields have been opened, and so much land made ready, as it were, for their operations, that they do not willingly forsake their homes to prospect new and distant and difficult tracts. But there is an unsettled, discontented, adventurous class, which is not to be restrained by any ties. Bold, accustomed to independence, and hardy and industrious, they are nearly always well off; but the very qualities which would lead to success and wealth—if they could live without excitement, and bear the monotony of mere daily labor—lead them to forsake certain profits in Victoria for the bare chance of something better in places where sober, thoughtful men would never think of risking their lives and their fortunes. It is to such men that we owe the most valuable discoveries, and they belong to a class which, as a rule, profits the least by them when they are made. They no sooner discover a new goldfield than they pack up their tents and blankets and move off to new tracts.

* *Gippsland Times*, 18th July, 1868.

The following is a list of the principal mining localities in the several districts of the colony :—

BALLAARAT.**CENTRAL.**

Ballaarat West	Pennyweight	Woolshed Lead	Sago Hill
Sir William Don Lead	Red Streak	Frenchman's Lead	Britannia Lead
Golden Point Lead	Old Post-office Hill	Little Bendigo	Milkmaid's
Inkerman Lead and Reefs	Specimen Gully	Deadhorse	Poverty Point
Newington Lead	Clayton's Hill	Jenkins' Gully	Scotchman's
Malakoff Lead	Sinclair Hill	Deadhorse Lead and	Newchum
Redan Lead	Whitehorse	Gully	Victoria
Ballaarat East	Ballaarat North	California Gully	Ashe's Lead
Black Hill and Flat	Gnarr Creek	Cambrian Hill	Gum-tree Flat
Brown Hill and Gully	Swamp	Winter's Flat	Essex Lead
Canadian	Suburban	Napoleon Lead	Nightingale
Prince Regent's	Springs	Black Lead	Terrible
Dalton's Flat	Sawmill Gully	Watson Hill	Miner's-right
Eureka	Lucky-hole Gully	Ross Creek	Bakery Hill
Gum-tree Flat	Nuggety Gully	Billygoat Flat	Gravel Pits
Sailor's	Blacksnake Gully	Glasgow Ranges	Caledonian Lead
One-eye	Sebastopol	Cherry-tree Flat	Cockatoo Gully
White Flat	Cobbler's Lead	Whim Holes	Mount Pleasant
Golden Point	Nelson Lead	Bunker's Hill	Red Hill

SOUTHERN.

Staffordshire Reef	Jackson's Gully	Hard Hills	Bulldog
Italian Gully	Yankee Hill	Pinchgut	Long Gully
Splitter's Gully	Grassy Gully	Frenchman's Gully	Little Hard Hills
Kangaroo	Spring Creek	Raglan	Kangaroo Hill
Moonlight	Sawpit Gully	Break-o'-day	Dog Trap
Mount Misery Creek	Whim Holes	Rokewood Junction	Sago Hill
			Paddy's Gully

BUNINYONG.

Napoleon	Union Jack	Magpie	Hard Hills
Watson's Hill	Glencoe	Cobbler's	Black Lead
Durham	Winter's Flat	One-eye	Long Gully
Green Hills	Hiscock's	Spring Hill	Franklyn
Scotchman's	Whitehorse	Newchum	

SMYTHESDALE.

Smythesdale	Springdallah	Snake Valley	Happy Valley
Haddon	Derwent Jack's	Madden's Flat	Monkey Gully
Scarsdale	Carngham	Linton	Lucky-woman's
Brown's	Bottle Hill	Bulla-Bulla	Mount Misery
Italian's	Preston Hill		

CRESWICK.

Creswick	Union Hill	Sulky Gully	Back Creek
Clunes	Long Point	Slaty Creek	Rocky Lead
Spring Hill	Diamond Gully	Mopoke	Pinchgut
Eaglehawk	Cobbler's Gully	Humbug Hill	Bullarook
Red Streak	Bald Hills	Portuguese	

GORDON.

Mount Egerton	Bull's-run Gully	Greed's Reef	Little Ben's Creek
All Nations Gully	Sawmill Gully	Providence Gully	Kerret Bareet
Big Hill Reef	Moorabool	Gordon	Cantwell's Creek
Parker's Gully			

Ballaarat—continued.**STEIGLITZ.**

Steiglitz	Dolly's Creek	Wallace's Ranges	Leigh
Morrison's	Stony Rises	Brisbane Ranges	Gympie
Tea-tree			

BLACKWOOD.

Golden Point	Main Creek below	Johnson's Reef	Goodman's Creek
Red Hill	Sebastopol	Barry's Reef	Werribee Creek
Simmons' Reef	Yankee Gully	United Reef	Split-tree Gully
Sebastopol	Ballan Flat	Lucky-hit Reef	Ranges
	Jackson's Gully	Newman's Reef	

BLUE MOUNTAIN SOUTH.

Lower Road	Wilson's Gully	Snake Gully	Kilkenny Hill
Old Camp Ground	Yankee Gully		

BEECHWORTH.**BEECHWORTH.**

Spring Creek	Two-mile Creek	Myrtleford	Sebastopol
Silver Creek	Three-mile Creek	Woragee	Eldorado
Deep Creek	Six-mile Creek	Reid's Creek	Reedy Creek
Hurdle Creek	Bowman's Forest	Woolshed	Buffalo River
Pennyweight Flat			

STANLEY.

Nine-mile	Europa Gully	Rocky Point	Deep Creek
Milkman's Flat	Back Creek	Nuggety Gully	Poverty Gully
Hurdle Flat			

YACKANDANDAH.

German Flat	McCarthy's Flat	Allan's Flat	Little River
Muddy Creek	Whiskey Flat	Staghorn Flat	Hillsborough
Murphy's Flat	Township Hills	Kinchington's Creek	Sutton
Hayes' Point	Pyke's Flat	Twist's Creek	Middle Creek
Kirby's Flat	Rowdy Flat	Clear Creek	Yackandandah Creek
Bell's Flat	Osborne's Flat		

SANDY CREEK.

Sandy Creek	Lockhart's Creek	Beazley's Flat	Niven's Flat
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INDIGO.

Chiltern Lead	Newcastle Lead	Perseverance Lead	Cornistown Lead
New Ballaarat Lead	Hibernian Lead	Wahgunyah Lead	All England Lead
Suffolk Lead	Glamorganshire Lead	Essex Reef	Prince Alfred Reef
Stockyard Lead	Robert Burns Lead	Devonshire Reef	Victoria Reef
Lancashire Lead	Eureka Lead	Wahgunyah	Campbell's Reef
Blackdog Lead	Rose of Sharon Lead	Nestor's Reef	Rose of Victoria Lead
Indigo Lead	United Consols Reef	Lambert's Reef	Glencoe Lead
Woodland's Lead	Magenta Reef	Moss Reef	British Queen Lead
Wallace's Gully	Minnie Reef	Rutherglen	Lucknow Lead
Devonshire Lead	Harris' Reef	Lanarkshire Lead	Garibaldi Lead
Durham Lead	Parish's Reef	Cornishman's Lead	Last Chance Lead
Caledonian Lead	Maiden Reef	Higgins' Reef	Victoria Lead
Clydesdale Lead	Two-and-one Reef	Harrierville Lead	Skeleton Creek

BUCKLAND.

Harrierville	Buffalo Ranges	Between Bright and	Freeburgh
Howard's	Growler's Creek	boundary of Divi-	Happy Valley
Bright	Morse's Creek	sion	Old Camp
Running Creek		Buckland River	Ovens River

MINERAL DISTRICTS.

Beechworth—continued.

JAMIESON NORTH.

Alexandra	Steel's Creek	Maindample	Devil's River
Spring Creek	Goulburn River	Dry Creek	Benalla Reefs
U.T. Creek	Ghin-Ghin	Mount Pleasant	Godfrey's Creek
Molesworth			

GAFFNEY'S CREEK.

Gaffney's Creek	Cannon's Creek	Moonlight Creek	Ryan's Creek
Goulburn River	Lyre-bird Creek	Cornhill Reefs	Wombat Creek
Raspberry Creek and Branches	Wallaby Creek	Bald Hills	Wild Dog Creek
	Victoria Gully		

WOOD'S POINT.

Wood's Point	Harper's Creek	All Nations	Toorak
Morning Star	Pheasant Creek	Maori Creek	Columbia
Lower Goulburn	Perkin's Creek	Edwards' Reef	Black River
Gooley's Creek	Waverley	Between Bald Hills and Matlock	Killar's Creek
Bald Hills	Emerald Claims		

BIG RIVER.

Big River	Warner's Creek and Reefs	Jim Thomas' Creek	Knowles' Creek
Frenchman's Creek		Fry's Creek	Enoch's Point
Eldorado Creek	Enoch's Creek	Seek-and-find Reef	Sebastopol Creek
Sixteen-mile or Bald-headed Creek	Railway Creek and Reefs	Darlingford	Jerusalem Creek
		Fryer's Creek	

MITTA-MITTA.

Mitta-Mitta River	Junction Granite Flat	Thunder and Lightning Creek	Snowy Creek
			Wombat Creek

JAMIESON SOUTH.

Howqua River	Jamieson	Mack's Creek	Sailor Bill's Creek
Cameron's Creek and Tributaries	Goulburn	Swampy Creek	Flume Creek

SANDHURST.

SANDHURST.

Axe Creek	Bendigo Flat	St. Mungo Reef	Myer's Flat
Milkmaid's Flat	White Hills	Devonshire Reef	Robert Burns Reef
Back Creek	Pottery Flat	Windmill Hill	Commissioner's Gully
Spring Gully	Epsom	Johnson's	Adelaide Gully
Sheep's-head	Ironstone	California Gully	Blue Jacket
Golden Gully	Huntly and Telegraph Line	Black Forest Reef	Splitter's Gully
Golden Square	Whipstick	Shellback Reef	Derwent Gully
Kangaroo Flat	Sydney Flat	Redan Reef	Sparrowhawk
Lockwood	Red Jacket	Sophia Reef	Long Gully
Shelbourne	Specimen Hill	Eaglehawk Gully and Flat	Tipperary Gully
Crusoe Gully	Moon Reef	Myer's Creek	White Horse Flat
Marong	Clarence Reef	Deadhorse Flat	Peg Leg Gully
Bullock Creek	Deadhorse Reef	Jackass Flat	Surface Hill
Victoria Reef	Catherine Reef	Deaddog Gully	Kangaroo Gully
Newchum	Snob's Hill	Job's Gully	Emu Creek
Long Gully	Eagle Reef	Star Reef	Sailor's Gully
Malden Gully	Comet Reef	Hustler's Reef	Nelson Reef
Ironbark		Prince of Wales Reef	American Reef
			Glasgow Reef

Sandhurst—continued.**KILMORE.**

Reedy Creek
Kilmore
Sunday Creek
Tea-tree Creek
Murrindindi Creek

Yea
Boundary Creek
King Parrot Creek
Strath Creek
Muddy Creek

Flat Lead
Golden Crown
Cotton's Finch
Rubicon
Thornton

Queen Parrot Creek
Snob's Creek
Goulburn River
Limpid Creek

HEATHCOTE AND WARANGA SOUTH.

Heathcote
Golden Gully
Long Gully
Opossum Gully
Caledonia Gully
White's Gully
Sailor's Gully
Red Hill
Commissioner's Flat
Wattle Flat

Redcastle
Wild-duck Creek
Green Hill
American Hill
Hard Hill
Rocky Gully
Patterson's Gully
Coliban River
Kimbolton

Campaspe
Tooborac
Mundy Gully
Ford's Gully
Surface Gully
Hayes' Gully
Fiddler's Flat
Costerfield
Argyle Gully

Peter's Gully
Jones's Creek
Swede's Gully
Parson's Gully
German Gully
Soap-bar Gully
Spring Creek
Old Antimony
Sawpit Gully

WARANGA NORTH.

Ruahworth Old Lead
Chinaman's Flat
Nuggety Gully and
Reefs
Balaclava
Main Gully, Whroo

Albert Reef
Carr's Reef
Coy's
Fontainebleau
Siberia
Growler's Reef

London Reef
Byron's Reef
Cherry-tree Reef
White Hills
Great Eastern

Welcome Reef
Murray Reef
Spring Creek
Buffalo Ranges
Paramatta Gully

RAYWOOD.

Raywood
Sebastian

Eldorado Flat
Kamarooka

Elysian Flat

Neillborough

MARYBOROUGH.**MARYBOROUGH.**

Maryborough
Havelock
Adelaide Lead
Moonlight Flat
Alma
Craigie
McCallum's Creek
Four-mile Flat
Chinaman's Flat
Mosquito Reef

Blucher's
White Hills
Balaclava
Inkerman
Bristol Gully
California Gully
Main Lead
Blackman's Lead
Golden Point
Majorca

Cockatoo
Harrison's Hill
Carisbrook
Mariner's Reef
Flagstaff Reef and
Gully
Waterloo Gully
Old-man Gully
Gibraltar

Water Flat
Mosquito Flat
Griffith's Gully
Nuggety Gully
Shicer Gully
Arnold's
Peg Leg Gully
Emu Gully
Smith's Gully

AMHERST.

Talbot
Scandinavian Lead
Rocky Flat
Mount Greenock
Nuggety Gully
Kangaroo Flat and
Gully
Mia-Mia Flat
Daisy Hill
Adelaide Lead South
Blacksmith's Gully

Emu
Cockatoo
McCallum's Creek
Goodwoman's Hill
Ballarat Hill
Black Lead
Mysterious Lead
Hard Hill
Long Gully and Flat
Grub Gully
Red Hill

Chapel Hill
Star Hill
White Hill
Moore's Flat
Opossum Gully
Green Gully
Amherst
Kangaroo
Grecian Gully
Battery Point
Shepherd's Flat

German Gully
Church Hill Reef
Laura Reef
Dana Reef
Whitehorse
Welcome Reef
Fincher's Reef
Back Creek
Surface Hill
Liverpool Lead

MINERAL DISTRICTS.

Maryborough—continued.

AVOCA.

Avoca	Mountain Hut	Fiddler's Creek	Paddy's Gully
Homebush	Green Hill Creek	Lamplough	Four Mile Flat
Amphitheatre	No. 1 Creek	Mountain Creek	Barber's Gully

DUNOLLY AND TARNAGULLA.

Dunolly	Llanelly	Pound Rush	Bulldog
Burnt Creek	Half-way	Old Lead	Shingle Gully
Bet-Bet	Murphy's Flat	Old Dunolly	Belgian Reef
Goldsborough	Cay's	Wattle Flat	Turkey Flat
Inkerman	Jones' Creek	Hard Hills	Ironbark Gully
Moliagul	Cochrane's	Little Chinaman's	Nuggety Flat
Bealiba	Gooseberry Flat and	Shules	Steven's Gully
Tunstall's	Hill	Wilson's Lead	Sporting Flat
Tarnagulla	Pottery Hill		

KORONG.

Korong	Kingower	Loddon	Jordan's
New Inglewood	McIntyre's	Kingarra	Scrub Rush
Old Inglewood	Sinnott's	Woolshed	Peep-o'-Day Gully
Thompson's Gully	Bourke's Flat	Garibaldi	Sailor's Gully
Jericho	Commissioner's Flat	Fenton's	Berlin Rush

REDBANK AND ST. ARNAUD SOUTH.

Redbank	Middle Creek	Forest Hut	Grumbler's Gully
Hines'	Moonambel	Stuartmill	Fighting Flat
Donkey Hill	Victoria Gully	Darling Flat	

ST. ARNAUD NORTH.

Rostron's	Blink Bonny	Middle Gully'	Dogberry
Edelsten's	Armenian Gully	Malcolm's	Banahee
Peter's	St. Arnaud's Flat	Geyer's Hill	Sheoak
Lower Carapooore	Ironbark Reef and	Gap Reef and Gully	Emu
Emu Bridge	Gully	Warwickshire Flat	Association Reef
Bristol Reef	Stewart's Hill	Kangaroo Gully	Warwickshire Reef
Greenock Reef	Wilson's Hill	John Bull Creek	Upper Carapooore
Chapman's	Chrysolite Hill	Jerejaw Reef	Cement Hills
Dair's	Sebastopol	Caledonia	Sawpit Gully
New Bendigo	Freiberg	Chance Reef	Jardine's Gully
Bell Rock	Queen Mary	Fishhook	Pioneer
Hopeful Reef	Forty-foot		

CASTLEMAINE.

CASTLEMAINE.

Castlemaine	Moonlight	Forest Creek	Wattle Flat
Barker's Creek	Pennyweight	Sailor's Gully	Adelaide Gully
Cobaw	Muckleford	Forty-foot Hill	White Flat
Campbell's Creek	Diamond Gully	Red Hill	Poverty Gully
Guildford	Specimen Gully and	Tipperary Flat	Hobby's Flat
Golden Point	Flat	Little Bendigo	New Chum Gully
Chewton			

FRYER'S CREEK.

Fryerstown	Tarilta	Strathbloddon	Chokem Flat
Golden Gully	Guildford	Pennyweight	New-year's Flat
Spring Gully	Guildford Hills	Hit-or-Miss Gully	Long Gully

Castlemaine—continued.**FRYER'S CREEK.**

Specimen Hill	Between the Loddon	Between Guildford	Middleton Creek
Church's Flat	and Holcombe	and Pickpocket	Butcher's Gully
Vaughan	German Gully	Pickpocket	Deadman's Gully
Butcher's Hill	Mopoke Gully	Hard Hills	Chapel Hill
Kangaroo Hill	Nuggety Gully	Jim Crow Creek	Glenluce
Between the Loddon	Sebastopol	Middle Crossing	Race-course
and Pennyweight	Green Gully	Blacksmith's Gully	Irish-town
Table Hill	Sailor's Gully	Murdering Flat	

HEPBURN.

Dry Diggings	Spring Creek	Stony Creek	Hard Hill
Glenlyon	Doctor's Gully	Wombat Creek	Italian
Pickpocket	Brandy-hot	Daylesford	Elevation Plains
Yandoit	Connell's Gully	Wallaby	Kidd's Gully
Forty-foot	Specimen Hill	Blind Creek	Middleton Creek
Boot's Gully	Deep Creek	Coomora	Long Gully
Jim Crow and Sailor's Creeks			

TARADALE.

Taradale	Wattle Flat	Barfold	Park Lead
Yankee Point	South Taradale	Belltopper	Back Creek
London	North Malmsbury	Bell's Lead	Coliban
Melbourne	Redesdale		

MALDON.

Beehive Hill	Green Gully	Fiddler's Flat	Gardiner's Gully
Back Creek	Hard Hill	Newstead	Pickpocket
Armstrong's Gully	Hunter's Rush	Nuggety	Sandy Creek
Eaglehawk Gully	Ironbark Gully	Pegleg Gully	Break-o'-day
Fryingpan	Long Gully, Muckleford	Porcupine	Sailor's Gully
Sandy Creek	Long Gully, Maldon	Strangeways	Mia-Mia
Frenchman's	Mount Tarrangower	Clydesdale	Porcupine Flat
Growler's Gully			

ST. ANDREW'S, EAST.

Donovan's Creek	Hoddle's Creek	Woori Yalloak	Cronin's Creek
Walsh's Creek	Bear's Creek	Big Bill's Gully	Nicholson
Yarra River	Emerald Diggings	Yankee Jim's Flat	Britannia
McMahon's Creek	Usher's Rush	Christmas Hill	Christmas Reef
Big Pat's Creek	Starvation Creek	Launching Place	Scotchman's
Warburton			

ST. ANDREW'S, CENTRAL.

Steel's Creek	Whiskey Gully	Queenstown Hill	Blackcalf
Yow-Yow	Old Caledonia	Panton's Hill	Wet Gully
Back Creek	Ferntree	Research Gully	Wilddog
Ironbark	Queenstown	Arthur's Creek	Ferntree Gully
Smyth's Gully	Yow-Yow Hill	Rocky Creek	Watson's Creek
Long Gully	Boomer's Gully	Scrubby Creek	Mountain Rush
Watery Gullies, 1 and 2	Pioneer Reef	Anderson's Creek	Slaughteryard Rush
Cherry-tree	Diamond Creek		

ST. ANDREW'S, WEST AND SOUTH.

Golden Gully	Tubba Rubba and Tributaries	Mount Martha Reefs	Sunbury Reef
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MINERAL DISTRICTS.

Castlemaine—continued.**KINETON.**

Lauriston	Spring Hill	Kangaroo	Eureka
Little Coliban			

BLUE MOUNTAIN NORTH.

Trentham	Amelia Reef	Alma Reef	Stony Creek
Newbury	Garlick's	Columbian	Trentham Creek
Main Flat	Gluepot	Blue Creek	Old Camp Ground
Dover Castle Creek	Frenchman's Hill	Mudlark	Doctor's Hill
Dry Diggings	Canadian Hill	Rocky Lead	

ARARAT.**ARARAT.**

Dutton's Gully	Moore's Reef	Opossum Gully	Far West
Napoleon Gully	Phillip's Flat	Soldier's Flat	Black Hill Lead
Armstrong's	Nil Desperandum	Inniskillen	Gibson's Flat
Ararat	Slaughteryard Hill	Wattle Gully	Long Gully
White Lead	Cathcart	Port Curtis	Londonderry
Canton Lead	Spring Lead	Moyston	Eaglehawk Gully
Commissioner's Hill	Bowman's Flat	Campbell's Reef and	Hospital Lead
Old Korns	Blackman's Gully	Gully	Snake Hill Lead
Deep Leads, old and new	White Lead	Alluvial Flat	Wet Lead
Black Lead	Shea's Flat	Camp	Surface Hill
Hopkin's	McNab's	Jonathan Gully	Shephord's Gully
Mulloch Bank	Swamp Gully	Sheep's-head Gully	

PLEASANT CREEK.

Deep Lead	Four-posts	Church Hill	Cook's Flat
Commercial-street	German Gully	Forty-foot	One Hole Lead
Cumberland Lead	Flying-doe	Fifty-foot	Welcome Rush
Quartz Reefs	Ironbark	Seventy-foot	Yellow Streak
Welshman's Flat	Shakespeare Hill	Twenty-five foot	Poverty Lead
Great Western	Elizabeth Creek	Silver Shilling	Doctor's Hill
Poverty Point	Cooper's Flat	Taylor's Gully	Bolangam
Wonga-Wonga Reef			

BARKLY.

Walter's Rush	Emerald Hill	Glenpatrick	Blue Mountain
Barkly	Ray's Rush	Landsborough	Chinaman's Lead
Frenchman's	Native Youth	Old Lead	Malony's Rush
Cambrian Lead	Malakoff	Milkmaid Gully	Charcoal Rush
Emu Flat	Glasgow Lead		

BAGLAN.

Beaufort	Palmerston Gully	Poverty Point	Fiery Creek
Jock's Lead	Waterloo	Sulky	Yam Holes
Old Main Lead	King Charles	Charlton	Swamp Gully
Long Gully	Sailor's Gully		

GIPPSLAND.**OMEQ.**

Livingstone Creek	River Tambo	Nicholson Bog	Upper Delegate
Cobungara	Swift's Creek	Little Plains River	Corangerah Creek
Upper Mitta-Mitta	Upper Bendoc River	Bonang River	Gibbo
Wombat Creek			

Gippsland—continued.**MITCHELL RIVER.**

Store Creek	Merri-jig	Two-mile Creek	Monkey Creek
Deptford	McDonald's Creek	Nicholson River	Barmouth Creek
Boggy Creek	Haunted Stream	Tambo River	Clifton's Creek
Sandy's Creek	Mitchell River	Shady Creek	

CROOKED RIVER.

Crooked River	Blacksnake	Wongungarra River	Thirty-mile Creek
Upper Mitchell	Dargo	Wonnangatta River	Twenty-five-mile Creek
Wentworth	Good Hope	Mount Pleasant	Pleasant Creek
Jungle Creek	Good-luck Creek	Twelve-mile Creek	

JERICO.

Between Matlock and Alhambra	Jericho	Moonlight	Garibaldi
Loch Fyne	Jordan	Aberfeldy River	Thackeray
B.B. Creek	Blue Jacket	Thomson River	Newchum
	Red Jacket		

DONNELLY'S CREEK.

Donnelly's Creek	Aberfeldy	Boy's Reef	Fulton's Creek
Store Point	Mount Useful	Independent Reef	Maxamilian Creek
Edwards' Hill	Morning Star	London Reef	Stuart's Gully
Crinoline	Edwards' Reef	Freestone Creek	Lee's Creek
Tullamore			

STRINGER'S CREEK.

Longfellow's Reef	Wellesley	Wealth-of-Nations	Stringer's Creek
Black Diamond	Walhalla	Scotia	Scrat-a-bit
Idahoe	North Gippsland	Perseverance	Eclipse
Hope	Golden Fleece	Eureka	Girl's Reef
Hercules	Happy-go-Lucky	Thomson River	Baw-Baw
Long Tunnel	Shamrock		

RUSSELL'S CREEK.

Russell's Creek	Charity Creek	Icy Creek	Red Hill
Tangil River	Wombat Creek	Tarwin River	Bonah's Gully
Hawthorn Creek	Good-hope Creek	Tangil River	Clarke's Gully
La Trobe River	Bull-beef Creek	Shady Creek	Ross's Gully
Cross-over Creek	Pheasant Creek		

SOUTH TARRAVILLE.

Merriman's Creek	Scrubby Creek
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Granite.



In the less elevated tracts, where this rock occurs, the hills are rounded and the valleys are narrow and shallow. Bare smooth masses of granite, as clean as if cut by the mason, rise out of the ground, and the bases are enfolded by a rich matting of grass and herbs. In parts where the rock is fractured, a she-oak or some of the smaller eucalypti take root, and spread their branches over the huge outstanding bosses.

In the higher lands the granites are imposing in aspect. The subordinate ranges are thickly timbered; and rising far above them, to the height of 3,000 or 4,000 feet, we see denticulated ridges and high steep cliffs of weathered rock and huge detached masses, white or grey or green, as the action of water has permitted or prevented the growth of the lower forms of vegetation. These bare summits, standing out boldly from the distant clouds behind them, and exhibiting precipices and rugged overhanging cliffs and deep clefts, are beautiful in summer, and singularly attractive to the tourist; but in winter, when their peaks are wrapped in mist, which is not a shroud but a gauzy veil ever-changing in its form, and the hollows of the heights are filled with snow, and white frothing torrents and thin flakes of foam come down perpendicularly, and show themselves but for a few minutes between the rifted clouds, the scene is one of no ordinary character, and leaves a deep impression on those who have been accustomed to view the aspects of nature in their higher significations.

Where the ranges do not exceed 3,000 feet in height (above the sea) the general appearance of the country is very different. The denticulated ridges are lower; large tors occupy the most prominent points; and while on one side of the granitic mass we see broken, cuboidal, and rounded blocks of vast size protruding from the ground, on the other we find smooth well-grassed slopes, and, scattered at long distances apart, low she-oak trees (*Casuarina*).

Where the area of the granite is extensive, and where it has been much eroded, so as to bring its surface to the level of the surrounding country, the rock is covered with the *débris* and the *detritus* of granite, and it is through these that the miner has often to sink in order to reach the gold-bearing stratum. Superficial observation, however, has led many to suppose that much of the country occupied by granite is merely covered with granite drift, whereas in fact it is granite decomposed *in situ*, and it would be vain in such places to search for auriferous alluviums. Thin auriferous veins might be found, but not drifts formed by the action of water.

The granites in general are of the usual ternary compound of quartz, felspar, and mica. At Wilson's Promontory there are schorly granites; and very large crystals of black tourmaline have been procured from veins in that locality by Lieut. Morrison.

Further north-eastward, in the granite near Omeo, Mr. Howitt has obtained splendid crystals of this mineral, having the characteristic unlike secondary planes at the extremities.

for the usual character
Some schorly

Near Baynton's Station, in the mass of granite west of the Campaspe, Mr. Norman Taylor, field geologist, has procured fine long crystals of tourmaline of various colors.

At Gabo Island the rock is syenite or syenitic granite, and hornblende replaces the mica in most of it; but it is not all of the same character. The felspar is pink or brick red; and in specimens taken from the surface, or near it, the felspar is fractured in every direction, and the lines are so minute as to be perceptible only under a lens.

syenite

Near Longwood small hexagonal plates of biotite occur, varying in color from dark green to nearly black; and in places in the same rock with this mineral garnets are found.



GRANITE ROCKS, near the Anakies.

From a photograph by R. Daintree.

In a patch of granite near Wahgunyah very large garnets have been found. Mr. Arrowsmith, the mining surveyor, has forwarded one for inspection—a twin crystal—about an inch in diameter.

Mr. Stone, the mining surveyor at Bright, some years ago forwarded to the Mining Department fine green plates resembling fuchsite, which were obtained from some plutonic rock in the vicinity of Morse's Creek. These valuable specimens were handed to Professor McCoy, the Director of the National Museum.

The granites of the Beechworth district are various in character. In some places the rock is fine-grained, consisting of small crystals of white felspar and iron-free clear quartz, and very small plates of black mica, and is very suitable for ordinary building purposes; and in other parts the rock is porphyritic, with large crystals of flesh-colored, cream-colored, and nearly white felspar and white quartz. This stone would be valuable for interior decoration. It is not very difficult to cut, and would present a fine but not a glossy surface.

At Mount Alexander are found the ordinary ternary granites, and pegmatite, and graphic granite. Numerous veins and patches of dark-colored, close-grained granite, and thin fissures wholly occupied by quartz, occur in the mass; and in places where the rock has weathered the thin quartz veins stand out rather prominently.

At Lake Burrambeet, granite protrudes and forms cliffs on the north-western shores. It is a coarse rough-grained rock, with large crystals of felspar.

At Mount Emu—a granite hill near Chepstowe—the quartz veins at once invite attention. The escarpments and steep faces of the rock are quite scored across with the white veins.

At Maldon are found lölingite, pyrrhotine, and other forms of iron pyrites; and near the junction with the silurian strata, where the granite veins intersect the sedimentary rocks, quartz veins cut through both the veins of granite and the sedimentary rocks. In such places the composition of the granite, or rather the mode in which the minerals composing it are arranged, is peculiar. Pieces are found in which the mica and quartz and felspar are severally aggregated in patches. At Nuggety Reef, near Maldon, the junction of the granite and the metamorphosed rocks is plainly seen. The granite rock is decomposed *in situ*, and one can cut away the soft kaolin-like mass with a spade. At one part the end of a large quartz vein is exposed; and it stands out sharp and clean, a bare, nearly smooth wall of hard white rock, where the soft decomposed granite is excavated.

The smaller and more recently formed veins of quartz, as already stated, cut through both the granite veins and the sedimentary rocks which they intersect, and thin strings of gold run through all these, showing, but not (in any specimens I could find on the spot) as clearly as could be wished, that the gold was deposited subsequently to the formation of the smaller veins. The miners take out the granite as well as the other vein stuffs, and send it to the mills to be crushed. The yield per ton in many cases is large.

In places where granite has been exposed for long periods to the action of water (but not in such a manner as to cause denudation) the rock is completely decomposed for a considerable depth, and in such spots we find good kaolin,

At Bulla-Bulla, on the Deep Creek, the clay is of excellent quality. In it are found magnesite and thin layers of milk-white and pellucid quartz, having nests and cavities lined with innumerable minute hexagonal prisms.

Near the boundaries of the granitic masses at Beechworth and Berwick (in the county of Mornington), oxyd of tin, sapphires, garnets, zircons, titaniferous iron-sand, pleonaste, and tourmaline are found.



Palæozoic Rocks.

It has been already stated that nearly 28,000 square miles of the surface of Victoria are occupied by strata which are the equivalents of the upper and lower silurian and Devonian rocks of Europe. Within this area there are metamorphic rocks, consisting of chloritic, micaceous, and granitoid schists, which, as far as is known at present, are not fossiliferous. One great band stretches southwards from the north-eastern tributaries of the Murray to the Tambo, and another lies within the basin of the Glenelg on the west. The great belt of upper silurians—everywhere rich in fossils, but almost destitute of beds of limestone—runs northward from Hobson's Bay.

When a section is made across the country—the horizontal and vertical scales being the same—the valleys in the palæozoic rocks appear to be insignificant in depth, and would suggest to the casual observer that there has not been much denudation in recent times. But it should not be forgotten that the greater part of the strata was probably worn away by the ocean, during periods when the land was being gradually upraised or slowly submerged, and that, under such circumstances, the waves would affect every point which they touched. The existing valleys have been sculptured by atmospheric forces (mainly), and these too would erode the hills as well as the valleys. The amount of erosion—the vertical extent actually removed—is to be measured by other signs; and those who desire to know what forces have operated in effecting the great changes which the geological map shows have occurred should consult the more elaborate maps, on the scale of two inches to the mile, constructed by the Director of the Geological Survey and his assistants.

In all the gullies and streams within the area occupied by palæozoic rocks we find alluviums; but they are generally thin and confined to the lower parts of the basins.

It is not possible to give even approximately the area occupied by these recent auriferous beds.

The course of the main streams nearly everywhere conforms to the strike of the rocks. The tributaries of the rivers are at right angles to them; and this system of drainage extends to the smallest basins. The configuration of the surface, consequently, is in many places curiously symmetrical. Running parallel with a main stream we see two ranges of hills with subordinate ranges at right angles to them; and from every little range oblong spaces of land, ending in low rocky prominences, run down towards the creeks.

Where the hills are very steep, and the strata are exposed, narrow bands of the harder rock, which have better resisted the action of the weather, appear on the faces of the declivities in ribbon-like forms.

Whether the country is high or low—whether at the sources of the Ovens or at Castlemaine or Sandhurst—the palæozoic hills are monotonous; and when the timber is removed, and the gullies are turned over, and their courses marked out by lines of red, yellow, and white clay, the landscape is dreary in the extreme.

Only in places where these rocks abut on the granites do they appear in forms which would attract the eye.

But it is only when they are divested of timber that they are ugly. Fully clothed with vegetation, and stretching onward for a great distance, the forests which they support give them a solemn and almost beautiful aspect. The sharpness of the ridges is concealed, and yet the valleys are not wholly hidden; and here and there a bold point rising high above the neighboring peaks throws a deep shadow on the undulating wooded surface, and serves by contrast to give almost a brilliant tone to the otherwise sombre expanse.

No one who, standing on a height, has seen the sun rise on a wide tract of thickly wooded palæozoic country would ever forget the picture, or cease to regard it as something beyond and foreign to his previous conceptions of what is beautiful in landscape.

Stringybark (*Eucalyptus Obliqua*) and ironbark (*E. Leucoxydon*) grow almost everywhere on the ridges, and the red gum (*E. Rostrata*) and the wattle (*Acacia*) are found on the banks and on the alluvial flats bordering the streams.

Though the soils appear to be poor they yield good crops to the gardener and vigneron.

Throughout their whole extent the upper and lower silurian formations present thin beds of yellowish-white, or reddish-brown argillaceous sandstones, with alternating layers of yellowish, brown and gray, and nearly black mudstones. Bands of hematite and small concretions of iron oxyd occur in many places plentifully.

"With a few local exceptions, they have a nearly true meridional strike or direction. Their great longitudinal extent is due to the crumpling, folding, and corrugating they have been subjected to, causing the same beds to recur again and again at the surface, in a succession of great synclinal and anticlinal undulations. Making due allowance for this repetition of the same beds at the surface, the total vertical thickness of the series (of lower palæozoic rocks) can scarcely be estimated at less than 35,000 feet." *

Some of the fossiliferous layers present at the outcrop a singular appearance, if a clean cutting be made at right angles to the bedding. The rock seems to be fissured and seamed in lines of curves of very small radius. All the carbonate of lime which once formed the shells having been carried away, and the spaces thus left not being filled with other matter, we can get only casts of the fossils; and though these are moulded in very fine argillaceous sandstones, they are not so easily recognised and described by the palæontologist as fossils from limestone beds.

Ripple-marked sandstones and mudstones, with numerous fossils, are common throughout the upper beds; and at Sandhurst, Gisborne, and other places, graptolite slates are found.

I purposely refrain from giving any account of the numerous fossils which have been collected by Mr. Selwyn, Mr. Aplin, Mr. Ulrich, Mr. Hodgkinson, and myself, because the geologist can get full information respecting many of them in Professor McCoy's pamphlet on the Palæontology of Victoria.†

* *Notes on the Physical Geography, Geology, and Mineralogy of Victoria*, by Alfred R. C. Selwyn and George H. F. Ulrich. 1866, p. 11.

† *On the Recent Zoology and Palæontology of Victoria*, by Frederick McCoy, Professor of Natural Science in the University of Melbourne, &c. 1866.

Before the opening of the Melbourne-Paris Exhibition in 1854, Mr. Selwyn and I had collected an immense number of fossils from the upper palæozoic beds ; and it is only just to state that Mr. Selwyn had himself determined the age and position of all the more important rock formations in Victoria some time before the fossils were exhibited in Melbourne.

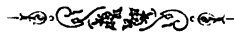
Enough will be stated in the pages which follow to give the reader a correct idea of the general character of these rocks and the veins which intersect them ; but the geologist cannot accurately estimate the extent of our resources, nor form a just conception of the forces which have operated in past times, without such a map as has been prepared by Mr. Aplin and Mr. Ulrich of the country lying between the River Loddon and the goldfields of Bendigo.

This map shows very completely the results of subaërial action ; and any one who will study it carefully will find in it an answer to those geologists who have urged that the greater amount of erosion everywhere has been effected by marine agency, and not by rivers, rains, and the wasting action of the atmosphere.

It has been observed that the Geological Sketch-map of the colony contrasts that of Great Britain, in there being absent from it those lines of strike of the different formations which appear with such regularity in the maps of countries which have been almost completely surveyed. This want will not be observed when the several beds forming the chloritic and micaceous schists on the west and east are thoroughly examined ; when the great masses of older palæozoic rocks are discriminated and mapped out with the same care as Sir Roderick Murchison and his able assistants have bestowed on this important work at home ; and when the palæontology and lithology of the subordinate groups of the newer palæozoic series shall have received such close attention as the fauna and minerals which they contain deserve.



Carboniferous Rocks.



The Government Geologist has examined the areas occupied by these rocks, and in his *Notes on the Physical Geography, Geology, and Mineralogy of Victoria*, he says:—"They occupy four distinct and separate areas, together 3,982 square miles, distributed as under:—

	Square Miles.
Wannon and Glenelg - - - - -	349
Cape Otway, including Barrabool Hills and Indented Head -	1,882
Cape Patterson to Traralgon, and La Trobe Valley - -	1,436
Welshpool - - - - -	315
Total - - - - -	3,982 "

This estimate properly includes much country which is covered in places by overlying tertiary deposits, and therefore is in excess of the figures given in the table showing the areas for the three natural divisions.

More recent explorations show that the area is even larger than here set down.

The physical character of the country differs very much from that observed in the great tract occupied by palæozoic rocks. High, well-rounded hills, some covered with a dense vegetation, and others only clothed with grass; wide valleys; steep acclivities, where issue springs of water impregnated with iron; and low marshy flats, are characteristic of these areas. The peculiarities of contour, and the composition and structure of the rocks, are so well marked as to enable any intelligent person to separate them from other formations.

At Cape Otway, and in the Western Port District, the timber trees are large and valuable; and where the finest forests are found the undergrowth is dense, showing that the soils derived from these rocks are as likely to reward the cultivator as any others in the colony.

Gigantic tree-ferns, fifty-one feet in height, were discovered in the Cape Otway Ranges by Mr. Charles Wilkinson, assistant field geologist, whose excellent reports, always accompanied by useful illustrations, diagrams, and maps, are well deserving of the attention of the geologist and the prospector.

The rocks generally consist of light-brown, greenish, and dark-brown layers of argillaceous sandstone, with seams containing impure coal and carbonaceous matter. The beds are in some places horizontal, and in others dipping at angles of 14°, 15°, and 18°.

Beds of blue claystone, resembling fire-clay, with numerous fossils and nodules of carbonate of iron, are not rare.

The strata at Bellarine, about ten miles east of Geelong, are thin; and a careful consideration of the sections, and a close examination of the rocks which occur in the shafts which have been sunk, lead to the supposition that, at this place, it is not probable that valuable seams of coal will be found.

In all the rich coalfields of other countries long continuance of the same forces is everywhere observable. Each stratum in the basin gives evidence of this: overlying the thicker seams we find even-bedded thick sandstones, shales, and clays, with carbonate of iron; but at Bellarine the strata are thin; they run out, and they are intercalated in such a way as to suggest that there were frequent changes in the direction of the currents which transported the materials composing them. The waters appear to have been charged at one time with siliceous matter, at another with argillaceous, and again with carbonaceous.

All the phenomena which are so well understood and so easily recognised by coal miners are absent here; and though it might be unsafe to speculate as to the character of the lower beds, it seems reasonable to infer that, at Bellarine, we are treading on the outer margin of the basin, where there was more disturbance of the waters than in the further interior part; or on upper beds formed of materials which were deposited in relatively shallow waters.

The character of the beds is well shown in the following section, which is taken from the official report of Mr. Richard Daintree, formerly field geologist in Victoria:—

Tertiary :—

	Feet	in.
Clays and quartz grits - - - - -	14	0

Carbonaceous :—

White and grey sandstone - - - - -	64	6
Dark-green shale - - - - -	13	10
Black shale - - - - -	1	2
Dark-brown shale - - - - -	9	6
Green sandstone - - - - -	7	0
Various colored shales - - - - -	34	0
Carbonate of iron - - - - -	0	4
Mottled shale - - - - -	4	8
Carbonate of iron - - - - -	0	3
Mottled shale - - - - -	15	6
Carbonate of iron - - - - -	0	7
Mottled shale - - - - -	27	0
Dark-brown sandstone - - - - -	0	11
Various colored sandstone - - - - -	11	9
Mottled shale - - - - -	39	6
Mottled sandstone - - - - -	3	6
Mottled shale - - - - -	10	0
Mottled sandstone with fragments of coal - - - - -	1	0
Green and grey sandstone - - - - -	21	0
Green shale - - - - -	10	2
Black shale - - - - -	2	0
Grey shale - - - - -	8	6

Total depth of bore - - - - -	300	8
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At Cape Otway and Cape Patterson the strata are different. There thicker beds of argillaceous sandstones, mudstones, and fossiliferous shales occur with regularity (where not disturbed by faults due to forces operating long subsequent to their formation); and these extend over large areas; and accompanying them are seams of coal not inferior to those which in other countries are profitably worked.

At Cape Patterson one seam—the Queen—is from three feet six inches to four feet in thickness; and another—the Rock—is about three feet six inches at the outcrop.

There are other seams varying from a few inches to one foot in thickness at the outcrop; but whether they are thicker in other parts of the basin is not known.

At the Bass seams of coal were discovered by Mr. Richard Daintree in March, 1859. Some of them show good coal, but they are not very thick. The lands where they occur are now held under lease by mining companies, and it is probable that something will be done to develop them if they be really workable.

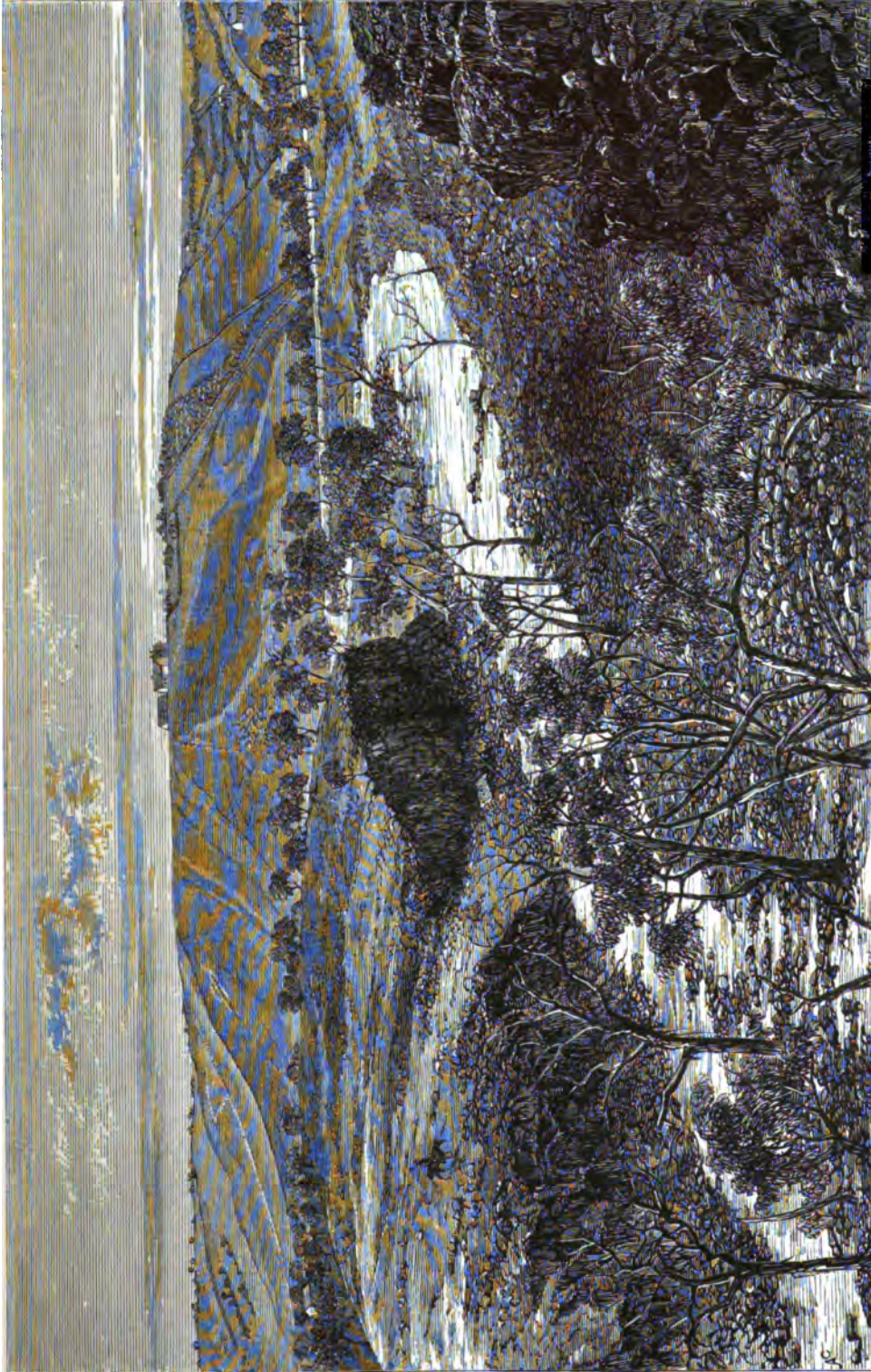
From surveys made under the direction of the Surveyor-General (Mr. C. W. Ligar) it appears that thin seams crop out about ten miles south of Buneep.

At Wormbete Creek, about two miles from its source in the Cape Otway Ranges, and about nine miles from its confluence with the River Barwon, near Winchelsea, there are coal seams which, at the outcrop, vary in thickness from two and a-half to five inches, and appear to be of excellent quality. The strike of the rocks, according to Mr. Selwyn's official report, is nearly north and south, and they dip slightly to the eastward; and the course of the creek being also north and south, it cuts through and exposes the same beds at different points. "The rocks associated with the coal consist of thick beds of grey and brown freestone, grey flags, and hard dark-blue nodular and rubbly shales, the latter containing imperfect impressions of the leaves and stems of plants. The whole of the beds are well exposed, both in the branches of the Wormbete Creek and also in the Retreat Creek. In the latter creek, which has an east and west course, or directly across the general strike of the strata, an almost continuous section of not much less than 600 feet in thickness is exposed; and therefore, if any seam of coal of workable thickness existed, it must be cut through and exposed in the above creek. After a careful examination, however, of the bed of the creek for several miles, I was unable to detect any evidence of such being the case."*

Sometimes mistakes are made by those who discover seams of coal at the outcrop or in bores. The section obtained by boring is seldom reliable. If the seam dip at a high angle the thickness is exaggerated, and false conclusions are formed as to its value.

And again, because a seam at the outcrop is only a few inches in thickness, it is too often hastily assumed that it is valueless. But in the coalfields of England and America the engineer is not guided by the appearance of the seam at the surface. He is aware that every out-cropping coal-seam is an outlet for the waters accumulated in the overlying strata, and that particles of coal are every hour carried down into the valley, and that the superincumbent rocks have a tendency to close over the seam and to hide it. Many seams of coal in Northumberland and Durham, which at some little distance from the outcrop are four, six, and seven feet in thickness, appear, near the streams which have cut through the carboniferous rocks, quite thin and poor.

* Report of Mr. A. R. C. Selwyn, dated 23rd October, 1856.



From a photograph by R. Daintree.

BARWON RIVER, NEAR FYAN'S FORD, GEELONG.

One seam, which is seven feet in thickness over a large area, shows only fourteen inches of coal at the outcrop; another, four feet, but eighteen inches; and another, seven feet, three feet six inches.

These facts should not be overlooked when an examination is made of a coal basin.

It is only too true that, up to the present time, the results of the operations of coal-mining companies have not been profitable. Good seams have been discovered, but they are not thick; and, occurring as they do in localities difficult of access, it will be long before they are thoroughly explored. Moreover, the expenses of working are very great; and, as the best coal can be got from New South Wales for less than thirty shillings a ton, there is no probability of large operations being successful, unless a thick seam be discovered in such a situation as to permit of the coal being brought to market in good condition and at no great cost.

The locality where perhaps a search for coal might be prosecuted with the best chances of success is that lying to the north of Welshpool and between the Franklin and the Albert Rivers. Only very feeble attempts have been made to test the beds; and the greatest depth to which the local coal committee carried their bore did not exceed, it is said, ninety-six feet six inches.

It was reported that at this depth a seam exceeding three feet in thickness had been found. The results of boring operations are, however, deceptive; and it is to be regretted that shafts have not been sunk, and stronger efforts made to investigate the character of the lower beds. This area is approached from a secure harbour, where there is deep water close up to the pier.

It is not unlikely that the oil-yielding schists which are said to occur in the Cape Otway Ranges and near Buneep will engage attention if it should happen that the supplies from the oil wells of America fall short.

Our future supplies of coal will be sought for, not on the margins of the basin, but in the lower parts of it, where, if we may judge of their character by what is known of coalfields of similar age in the adjacent colonies, the thicker seams invariably occur.



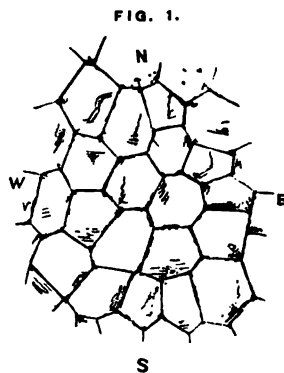
Basaltic and Volcanic Rocks.

Low flat plains, broken here and there by winter torrents, which have scooped out narrow beds ; vast plains, where, as far as the eye can reach, the surface is level and not relieved by even a shrub ; rocky points and heaps of volcanic *débris* ; isolated mammiform hills ; undulating country, with numerous crateriform hills and lakes of salt, brackish, and fresh water, in the vicinity of which the country is richly grassed and lightly timbered ; steep cliffs, where the streams have cut through basalts, sedimentary tertiaries, and schists ; and bold black promontories and islands on the coast, are characteristic of the country where the older and newer volcanic rocks occur.

These rocks extend almost uninterruptedly for 240 miles from east to west ; and patches and outliers to the north and to the south are more than 130 miles asunder. A large area, once covered by basaltic and volcanic rocks, has been denuded, so as to expose the underlying strata ; and what vertical extent has been carried away by water, in those places where there are still thin sheets remaining, it is impossible to conjecture. The denudations which have taken place since the newer volcanic rocks were erupted may be measured roughly by connecting the existing outlying patches by hypothetical lines with the larger areas ; but, as regards some of the older basalts, we can form no conception of the areas which they once covered. All the overlying sheets have been eroded, and they are found now, usually, only as intrusive dykes.

Some of the newer basalts, as well as the older, exhibit a columnar structure. The following plan (Fig. 1) shows a floor of newer basalt, which is exposed in the bed of the Merri Creek, near Pentridge. It is reduced from a large drawing furnished by Lieut. Colonel Champ, to a scale of one-eighth of an inch to one foot.

The newer rocks, though in most places vesicular and even spongy in texture, afford good building stones ; but the older basalts are much decomposed. Near Essendon, the escarpments, when excavated, show masses of nearly white, cream-colored, and light-brown clays, with lines of a darker tint, indicating what were once the shrinkage cracks. The concentric structure is better observed where the decomposition has not progressed quite so far ; but even where the mass is reduced to a soft clay there are always to be found nuclei of hard, dense, nearly black basalt. In the coatings occur brown hematite and quite large pieces of ferruginous opal.



The cuttings made to form the Melbourne and Echuca railway, between Spencer-street station and Footscray (where the newer volcanic rocks occur), are through the older basalt; and the geologist could not collect anywhere else, within so small an area, better illustrative specimens of our igneous rocks.

These sections through the older basalts are very instructive. They show how a change of composition and a re-arrangement of the atoms forming what was once a solid dense rock may entirely efface the original structure. In many of these sections we see what appears to be an aggregation of large balls, six, seven, and twelve feet in diameter, formed of concentric layers of clay and friable gritty earth, stained with hematitic iron. The layers, however, are not in every place concentric. Thin sheets of basalt superimposed one on the other decompose somewhat differently, and a stratified appearance is presented in the section, which one who has not studied the protean forms of this rock might easily believe was due to the action of water.

In the Lake District, where there are numerous extinct volcanoes, we find light spongy lava, pumice, trachyte, obsidian, and coccolite. The walls of some of the craters—such, for instance, as those of the Warrion Hills—are distinct and well preserved, and the scorix look as if they had not long since been subjected to heat; but this appearance, it is scarcely necessary to say, is deceptive. From the base of some of the steep hills pieces of lava have been taken which curiously resemble fossil wood. One large piece was brought to Melbourne, and exhibited as a fossil tree.* These odd-looking specimens are formed probably of thin sheets of half-molten matter, which have been broken off larger masses, and have rolled down the steep smooth sides of the declivity. An examination of a section shows that the rings are not concentric and perfect, but are continuous from the centre, as in a piece of paper when rolled up.

Very thin flags of basaltic lava are obtained at Kerange-Moorah, near Korangamite, which are sometimes put to useful purposes.

A piece of country lying near the south-western shores of Lake Korangamite, called the Stony Rises, more nearly resembles a recent volcanic tract than any other in the colony. The smooth cone—Mount Pordon—rises in the midst of small craters, broken currents of lava, and roughly-piled heaps of basalt. It is not easy to make one's way on horseback through this rocky maze, where swamps and small, deep craters appear on every side. When the swampy lands are flooded by the winter rains the overflow finds a devious course through the rocks. The waters carry away the loose earth and the smaller fragments of lava and basalt, and the large blocks tumble down from their old sites and add to the confusion.

The sad-colored gum, the bright foliage of the lightwood, and the rich tints of the shrubs and ferns, and the waving forms of the tall grasses, have additional charms when contrasted with the dark rocks and relieved by the light and shade of this rough and hilly country.

Areas having a surface somewhat similar to that just described are found at Mount Fyans, Mount Rouse, and Din-dirnum.

* What is supposed to be the cast of a tree in basalt is now in the Exhibition Building in Melbourne. It was got, I believe, from the quarries at Footscray. The roots, stem, and branches, and the corrugations of the bark, seem plain enough. But the imitative forms approach so closely to the natural that one hesitates to give a decided opinion on such a specimen. The behaviour of lava currents in wooded districts, as described by Mr. Dana, would lead to the supposition that, under some circumstances, a tree might be destroyed and the cylindrical hole might subsequently be filled with molten lava. The specimen in the Exhibition may have been formed in this manner.

On the plains occurs what is called by travellers "Bay of Biscay" country. Humps of earth, like graves, lie close together, and give to a swiftly-travelling coach a motion more disagreeable than that of a ship beaten by the waves of the Bay. In such places there is no drainage; the rain falls and settles where it falls, and, percolating through the shrinkage cracks of the basalt, hastens decomposition. From between the joints the earth and clay are removed by the waters bit by bit, and in time the grassy surface conforms to the unevenness of the underlying rock. The causes which have produced this condition are best observed in places where a stream has cut through the rocks, and where a section is exposed; but wherever the cutting-back power of water scoops a channel so as to drain the land the effect ceases.

In many places tertiary limestone and calcareous sandstone overlie the basalts.

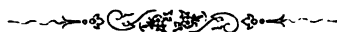
The proportions of the chemical constituents of the volcanic rocks are variable; but the analyses of specimens taken from the older and the newer layers do not always present such differences as would enable the geologist unacquainted with their origin to class them rightly. It is easy, however, to discriminate the rocks when we see the masses *in situ*; but so many chemical changes have taken place in both, by decomposition and by infiltration, that the results obtained in the laboratory are rather perplexing. Mr. Cosmo Newbery, the Government Analyst, has lately been investigating the character of these rocks, and some analyses made by him have been published.

Two are selected for comparison:—

OLDER VOLCANIC.				NEWER VOLCANIC.			
Phillip Island.—Dense black, containing crystals of olivine. Soluble in hydrochloric acid, 49·18; insoluble residue, 50·82 = 100·00.				Dark crystalline rock from the Leigh Grand Junction Company's shaft; 24 per cent. soluble in hydrochloric acid.			
		Soluble Portion.	Insoluble Portion.			Soluble Portion.	Insoluble Portion.
Si.	O. ₂	34·16	49·46	35·44	54·73	Silica	
Al.	O. ₃	23·22	8·21	8·13	19·12	Alumina	
Fe.	O. ₃	12·09	Fe. O. 16·32	31·43	Fe. O. 6·03	Iron	
Ca.	O.	5·21	7·26	5·24	10·14	Lime	
Mg.	O.	12·34	18·76	17·33	5·05	Magnesia	
K.	O.	3·10	...	trace	2·11	Potash	
Na.	O.	5·28	...	1·40	0·50	Soda	
H.	O.	2·16	...	2·03	...	Water	
Mn.	O.	0·46	trace	...	...	Manganese	
Ti.	O. ₂	0·04	...	...	...	Titanic acid	
		98·06	100·01	101·00	97·68		

These rocks, taken from localities widely apart and belonging to different ages, are yet not very dissimilar in composition. Hand specimens, however, could be obtained from either place altogether different in appearance.

In the newer basalts are found coccolite, christianite, and many zeolites in cavities, with carbonate of lime and acicular aragonite. Zeolites occur also in the older basalts. For information respecting these minerals the reader is referred to Mr. Ulrich's *Notes*, published with the *Records of the Intercolonial Exhibition*.



Tertiary Rocks.

For the purposes of this description all the alluviums overlying the palæozoic rocks, and all the volcanic rocks, are excluded.

The principal areas occupied by recent tertiary clays, sands, and drifts are—that within the basin of the River Murray, about 26,500 square miles in extent; that in Gippsland, lying near the Lakes; and those bordering the coast in the Western District.

There are small areas, similar to that which is found on the shores of Port Phillip Bay, near Mount Eliza, occupied by what Mr. Selwyn supposes are rocks of eocene age; but there is no reason to believe that eocene rocks are generally distributed.

The areas occupied by miocene rocks are 2,059 square miles in the Western District, and 1,360 square miles in Gippsland, making a total of 3,419 square miles. These present features more interesting to the geologist than to the miner; and for information respecting them the reader may consult the maps and papers published by Mr. Selwyn and his assistants.

The tertiary country within the Murray basin is low and level. It slopes gradually from the east to the west (following the trend of the river) and from the south to the north.

Lake Albacutya, which receives the overflow of Lake Hindmarsh, is about 200 feet above the sea; and about twenty miles to the north, where occur flat basins and shallow clay-pans, occasionally flooded by the overflow of Albacutya, the country is not more than 185 feet above the sea-level.

About fifty-six miles to the north, near Mournpall and other lakes, which probably mark what was once the junction of the Wimmera with the Murray, the height of the land is about 177 feet.

Coornong Swamp or Lake, which receives the waters of the Yarriambiack Creek, is 189 feet; Quambatook, on the River Avoca, is 290 feet; and Lalbert Swamp, to the westward, is 245 feet above the level of the sea.

In the north-western parts sandhills 200 feet above the level of the surrounding country are quite conspicuous features in the landscape.

It is probable that the mean height above the sea of this extensive area is less than 200 feet.

The apple-tree (*Angophora Intermedia*), and small stunted eucalypti, grow in the upper eastern portion of the basin.

In the western and north-western parts there are large tracts covered with dense mallee scrubs, composed of *Eucalyptus Dumosa*, *E. Oleosa*, and *E. Socialis*. We find here also the water-tree (*Hakea Stricta*), from the roots of which, as well as from the mallee, travellers are sometimes compelled to procure water. By tapping the roots a fair supply is obtained in this arid tract. The desert cypress-pine (*Callitris Verrucosa*), the native peach (*Santalum Acuminatum*), the native sandal-wood (*S. Persicarium*), and the sugar-tree (*Myoporum Platycarpum*), are scattered in patches between the belts of mallee.

The pine plains and pine clumps are well-marked features in the central parts of this area.

The area is not well watered. Some of the rivers in the western part, as already stated, lose themselves in the sands. The lakes, though numerous and some of them large, are in groups; and these are far apart, and many are salt. The explorer, consequently, is glad to avail himself sometimes of the services of a native guide, who knows exactly where and how to tap the roots of the water-trees.

Sandy soils prevail generally, with here and there "clay-pans,"—probably old lake beds.

The character of the country to some extent influences the climate; and that again, so modified, regulates and determines many of the lesser phenomena which we observe in the physical geography of this part of the colony. In this low flat tract very little rain falls, probably not more than seven or eight inches per annum (except perhaps during very wet seasons), and evaporation is excessive, owing to the high temperature of the lowest stratum of the air. The siliceous soil in the low bare sheltered spots rapidly gains a high temperature during a cloudless day in these latitudes; and there is more radiation perhaps than would be conjectured, even having regard to the character of the constituents of the soils.

Besides, much of the surface waters is absorbed. Under these circumstances the streams, as might be expected, are weak, and incapable of effecting such changes as usually take place even in a level low country where the rains are copious and the atmosphere humid, or where the main channels are filled with water from zones of precipitation embracing their sources.

The beds generally are sandy, calcareous, and gypsiferous. Wells have been sunk north-west of the River Wimmera, and fresh water obtained, but not of good quality. A section obtained by the Government Geologist shows the following strata:—

	Feet.
Yellow and blue clay - - - - -	40
Clay mixed with sand - - - - -	5
Variously colored sands - - - - -	35
Very fine white sand - - - - -	20
Sandstone - - - - -	30
Sea shells and sand where the water was struck - - - - -	...
Total depth - - - - -	130

Miocene tertiary fossils are found in many places in the south-western part of the area.

Salt and gypsum occur in some localities; and about six years ago it was proposed to bring the sulphate of lime into the market, but the scheme was not pursued.

It is in this tract that we may hope to find profitable saline springs, beds of lignite, and perhaps rock-oil.

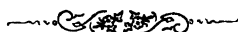
Gradually the *leads* of gold are being followed into the area of the Murray tertiaries; and there is no reason to believe that they will not be valuable.

So little is known of the character of the drifts in such tracts that it would be idle to speculate as to the amount of wealth which may lie buried in the strata which compose the Murray basin. In some parts it has been proved beyond doubt that rich *washdirt* may be got; and that is enough to give an impetus to prospecting. It will be long, however, before the miner risks his time and money in explorations in localities where the rocks are different in character and position from those with which he is acquainted. The encroachments on this area will probably proceed slowly; and it is better that prospecting should not be hastened by suggestions which are not based on observed facts.

This remark is intended to apply, not to these localities where *leads* are traceable downwards from the palæozoic hills into the tertiaries, but more particularly to the vast tract north of the 36th parallel and west of the 143rd meridian.



Unexplored Tracts.



The limits of the areas which are unexplored are being gradually reduced, but there still remains much country which, for all practical purposes, is unknown to the miner. It is not enough for his purpose that the country is occasionally visited by stockmen, and now and then travelled over hastily by some stranger bent on making the shortest route to his destination. As regards mere occupation, we know that nearly every part of Victoria is included in some sheep-run; but this was its condition before the goldfields were opened, and helped little towards the development of the mines. Every day fresh discoveries of gold-bearing rocks and mineral lodes are being made in places which have had a small population in their vicinity for years; and we have no reason to assume that a tract is non-auriferous because, up to the present time, it has not attracted the attention of the miner.

No part of the country can properly be considered as explored until the principal physical features and the character of the rocks are known; and respecting these, over some quite large areas, we are ignorant.

If we accept the first draft of a map showing the distribution of our rocks as absolutely correct, and regard only what it broadly asserts and not what it suggests, it loses its character as a guide and betrays us into error.

Many of the tributaries of the Snowy River and the inferior streams belonging to them, with their systems of drainage, were until recently almost unknown; but within the last two or three years—since the district has been under the charge of Mr. Alfred Howitt, who is a skilful miner and a bold explorer, and well able to direct the miner to the most likely localities for gold—there have been numerous discoveries made, and the once silent glens and almost dismal swamps are now peopled with active hardy pioneers, who have opened alluviums, discovered veins, and brought the best machinery, with the newest appliances, to bear on the reduction of vein stuff.

The lofty ranges at the sources of the River Mitta-Mitta, and the creeks known as the Gibbo, the Thowgla, the Corryong, and the Cudgewa, with their low-lying flats, small elevated plains, and isolated peaks, are likely hereafter to support a large population. The prospecting parties which tested parts of this area some eight years ago found nothing to reward their labors; but the tract is extensive, and the country and the rocks are very different from the older goldfields; and we must not too rashly conclude that the micaceous, talcose, and chloritic schists of this region are non-auriferous. The goldfields of Omeo and Livingstone lie in basins composed of rocks of similar age; but just where they occur there are signs which would suggest that the gold found in the drifts may have been derived from the adjacent lower silurian rocks.

Little is known to the miner respecting the sources of the River Whorouly, the River King, or the Holland, where an area of seven hundred and fifty square miles—

surrounded on every side by profitable goldfields—lies up to the present time untouched by the prospector ; and all that is known of the rocks would lead to the supposition that they are intersected by reefs of the same character as those found near Morse's Creek and at Harrierville.

The basins of the Niagara, the Rubicon, and the Acheron (with its tributary the Niagaroon Creek) have never been thoroughly tested, though gold has been found ; and here there are at least three hundred square miles of palæozoic country lying quite close to well-known goldfields.*

The large patch of silurian rock abutting on granite which lies to the north of Cape Liptrap has not yet been touched, and it is scarcely creditable to the inhabitants of Gippsland that they have allowed it to remain practically unexplored. Gold has been found in the north-eastern extremity of the patch, and the inducements to prospect are sufficiently strong.

The basin of the River Macalister, in Gippsland, is composed mainly of lower silurian rocks ; but neither the rich alluviums lying in the adjoining basin on the west, nor the valuable quartz reefs now being wrought with so much profit on the east, have induced persistent research in this area.

All the tributaries of the River Goulburn which have their sources within the boundaries of the great mass of granite stretching north-eastwards from Mount Mackenzie, near Broadford, to Mount Pleasant, about seven miles south of Benalla, are undoubtedly auriferous. They cut through rocks of silurian age, and we may expect to find rich reefs throughout the whole extent of them. There are patches of auriferous drift near Mount Mackenzie and at the other extremity near Mount Pleasant, and it is only accident that has led to the opening up of these. Let us hope that the intervening tract, some sixty miles in length, will not long remain neglected.

In directing attention thus pointedly to these large areas, it is right to state that the supposition that gold will be found in them is based solely on the known character of the rocks which occur in their neighbourhood. The beds, and the plutonic masses lying in the midst of them, are probably similar to those which are found in the principal goldfields.

The miner, however, is not obliged to travel far to find new country ; in the neighborhood of the older goldfields there are quite extensive tracts yet undeveloped. Not to speak of the *leads* which have been abandoned in consequence of the difficulty of draining deep ground—and there are many—it is well known that near Dunolly, Maryborough, St. Arnaud, Avoca, Navarre, Inglewood, Heathcote, and Ararat, there are gullies, flats, and reefs which have never been touched.

When travelling between Eddington and Dunolly, I was astonished to see an extensive area of good country where apparently not a shaft had been sunk nor a single trial made ; and still more remarkable was it to observe the state of the hills and gullies quite near Dunolly. They are all auriferous, but no strong effort has been made to get the gold from them, though the *washdirt* of this place is richer in nuggets than any other in the colony.

The old miners prefer to work and re-work the well known gullies and flats rather than spend their time in making trials in new ground, which, if successful, most often result in rushes ; and when there is a rush (unless the bye-laws happen to be in a state of more than ordinary obscurity), the prospectors, not infrequently, lose their claim.

* Since this was written a goldfield has been opened at Murrindindi on the Murrindindi Creek, and there is now a prospect of further explorations being made in this hitherto neglected area.

It has been often stated that the miners, curiously enough, accidentally opened the richest fields at first; but those who make this statement, and those who believe it, have not taken care to examine the facts. At first any new discovery—the finding of any rich pocket of gold—excited the public mind, and, even without exaggeration, the facts made known in the early days of our gold mining were startling; but more extraordinary results are obtained now, week after week, than any which have ever been chronicled, as far as is known, in gold-mining countries.

When we read a paragraph of two or three lines in a country newspaper, informing the public that a mining company raises ordinarily more than a ton of gold in twelve weeks, and that a few companies at Ballaarat, with no more expensive or intricate appliances than are commonly used in coal pits at home, can get out and bring to market some four or five tons weight of gold in the same time, there is neither surprise nor excitement.*

The public has become accustomed to regard these as ordinary occurrences, and fails to contrast them with what was presented for their observation some twelve or thirteen years ago.

Again, the yields from our reefs have seldom at any period exceeded what has been obtained quite lately from the new goldfields in Gippsland and Beechworth; and if the miners had not possessed good appliances for crushing—if they had been compelled to pick the stone—the results would have been so extraordinary as almost to exceed belief.

In fact, our prosperity—paradoxically—stands in the way of our advancement. If our miners were not well off—if they had not machinery to aid them—if they were obliged to select only the richest stone and to pound it in a mortar—the results of their labors, when made known, would attract hundreds of able-bodied men to our shores. But merged in averages, and given in bulk, they fail to convey intelligence which excites the mind.

The yields of gold, both from alluviums and quartz reefs, which are recorded in this volume as having been obtained quite recently, are not less astonishing than those which served to bring thousands of immigrants to our shores in 1852 and 1853.

In order the better to elucidate the character of our rock formations, I have sought Mr. Selwyn's permission to re-publish here his excellent sketch-section from the western boundary of the colony to Lake Victoria in Gippsland.

It will enable the reader to form something like a reasonable estimate of the extent of the auriferous rocks of this colony, and will probably induce the geologist to seek for further information in the numerous reports and maps prepared by the officers of the Geological Survey.

* Not only at Ballaarat but in other districts very large yields are far from uncommon.

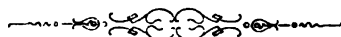
Mr. W. H. Foster, the warden at Sale, in his report for the month of August, 1867, states that 2 cwt. of gold were obtained in a week's crushing at Stringer's Creek. The quantity of stone operated on was 660 tons, and the average was more than 5 ozs. per ton.

A sample of quartz taken from the Swedish Reef—about sixteen miles from Melbourne—gave gold in the proportion of about one-eighth of the stuff treated; the yield being at the rate of 3,854 ozs. per ton.

Much of the washdirt in the richer gutters yields 18 dwts. per cubic yard.

Having regard to these facts, and looking at the scale of wages current on the goldfields (from twenty shillings to sixty shillings per week for unskilled labor), and to the immense area of shallow alluviums where an industrious man can earn from £1 to £3 a week, and remain the sole master of his own time, it is surprising that a few exaggerated statements of the yields of quartz at Gympie and other places in Queensland should cause our miners to rush the Savings Banks, and carry their hard-earned moneys to a country where severe labor during a great portion of the year is almost insupportable—where fever lurks in every swamp and ague in every breeze.

Discovery of Gold in Victoria.



In the year 1788 it was announced that gold had been discovered in Australia; but the statement was not credited, and it rested probably on no better evidence than that on which the companions of Sir Francis Drake based their report of the auriferous and argentiferous character of the rocks of California when they explored that country in 1579.

It is undoubtedly true that the few facts made known relative to the modes of occurrence of gold in Europe and America, and the hasty generalizations of travellers respecting the rock formations of Australia, had for a long period occupied the attention of many persons in England; and a few amongst them, from time to time, prophesied that gold would be found on the slopes of the Cordillera; but everything that was said applied with equal force to every spot of the globe where palæozoic rocks appear at the surface.

Amongst so many claimants—all clamoring for the reward which they believe should follow on a prophecy fulfilled—there is not one who can say that he gave a clear account of the manner in which gold would be found in the rocks of Australia. Each claims consideration because he had stated that gold would be found somewhere, somehow, and that people ought to look for it; but it was not until an adventurous person actually dug up the soil and washed it that the thing was made clear.

It is said that gold was found in the Pyrenees by a shepherd in 1849; but long before this it was known to the settlers that gold was to be obtained. Their servants collected it and sold it; but those who might have developed the fields, having no knowledge of gold mining, nor knowing where they should seek for gold, did nothing. Their shepherds were men generally of doubtful or bad character, and it is probable that the settler regarded the gold dust as the proceeds of some successful robbery rather than as the product of the soil; and the obscure hints and hesitating manner of an assigned servant would not probably tend to produce an impression favorable to any other supposition. Little attention was given to the matter. Men's minds were directed in the early days of the colony to another pursuit. They traversed the country for the purpose of finding runs for sheep and cattle; and, having found these, they were content. They knew nothing of goldfields; and the discovery of small pieces of gold was not enough to induce them to forsake a business promising certain wealth for another which might involve them in ruin.

But for the sudden development of the gold mines of California, the people of Victoria might have long remained ignorant of the wealth of the colony. The discoveries in that part of America had an immediate beneficial effect. They differed in their results altogether from the vaticinations of the students and travellers. They

turned the attention of practical men to the search for gold in New South Wales and Victoria; and, aided by the experience gained in California, the prospectors succeeded in opening up profitable fields in many widely separated localities.

Gold was found at Clunes, it is said, in March, 1850; on the 10th June, 1851, it was discovered near Burnbank, on a tributary of the River Loddon; on the 20th July at Mount Alexander; on the 8th August at Buninyong; and on the 8th September, in the same year, at Ballarat.

Licenses to dig were first issued on the 1st September, 1851.

In 1851 the people of Melbourne were anxious that some important discovery should be made which would have the effect of attracting population to Port Phillip. Storekeepers and landowners beheld their prospects growing more dismal day by day. The value of every description of property was depreciated; men were moving off to the goldfields in New South Wales; and it became necessary to make some effort to arrest the current of events, even if that effort should not lead to any permanently beneficial result.

There were some gleams of hope too. From the newspaper reports of the period it appears that a parcel of gold obtained by two men in the Plenty Ranges was exhibited on the 26th May, 1851; and on the 4th June another sample, brought from the Pyrenees, was shown in the shop of Mr. Crate, watchmaker, Swanston-street; and about the same time some 300 persons were prospecting the Plenty Ranges.

In view of these facts, some of the leading citizens convened a public meeting in Melbourne on the 9th June, 1851, when a committee was appointed for the purpose of obtaining subscriptions towards a fund to be applied to the payment of a reward to any person who should disclose to the committee the locality of a "gold mine or deposit," capable of being worked to profit, within twenty miles of Melbourne. Subsequently the committee decided to offer a reward of 200 guineas for the discovery of a goldfield within 200 miles of Melbourne.

Whether or not these offers induced persons to prosecute the search, it is certain that many discoveries were made immediately subsequent to the publication of the notices.

On the 17th June it was reported that a piece of quartz richly studded with gold had been found at the Merri Creek, and on the 20th June gold was brought to Melbourne from the King Parrot Creek. It was stated also at this time that gold was to be got at the Deep Creek, near the Yarra; and good accounts were received from the Pyrenees, where about forty men were at work. One man more fortunate than his neighbors had washed two and a-half ounces in a week.

Towards the end of July, 1851, the rich ground lying adjacent to the reefs at Clunes and at Anderson's Creek had been partially opened; and a Commissioner of Crown Lands was despatched to the last-named place to make an inspection.

On the 13th August a piece of gold was found by a little girl in Swanston-street, and a number of people commenced to dig; but whether or not they succeeded in finding any more nuggets or dust is not stated.

All these accounts were, however, as nothing when compared with the startling intelligence which came from Buninyong on the 14th August. The reports published in the newspapers were indeed sufficient to cause astonishment. Mr. Stewart—who appears to have been recognised as an authority at this period—"believes the whole country in the neighborhood is rich in gold, and a very general opinion prevails that the auriferous district extends close to Geelong, and from thence towards the coast of Port Fairy, and inland to and even beyond the Pyrenees Ranges."

The adult male population of Geelong appears to have gone to the diggings about this time ; and, notwithstanding that there was only one cradle at Buninyong, the miners succeeded in getting a good deal of gold. The owner of the cradle cleared £6 one day and £3 10s. the next. One woman obtained thirty shillings' worth of gold as the result of a day's work ; and a little boy, washing the earth in a pannikin, got 50 grains.

At this period His Excellency the Lieutenant-Governor issued a proclamation, setting forth the terms on which gold miners would be permitted to search for gold. Each miner was required to take out a license and to pay for it at the rate of eighteen pounds sterling per annum ; and there was some dissatisfaction in consequence, but it was not universal.*

On the 8th September, 1851, four men were working at Mount Alexander, and they wrote a letter in a newspaper stating that they were willing to pay a reasonable fee for the privilege of mining.

Further reports from Buninyong, dated the 1st September, 1851, show that small yields were sufficient in those days to excite men's minds. The local correspondent thus wrote :—"Shipman, Surplice, and another got about $\frac{3}{4}$ oz. yesterday ; Connor's party, just getting into working order, netted an ounce ; the Mutual Association of five got a quarter of an ounce ; Binder's party of four, a quarter of an ounce ; Wait's party of four, half an ounce ; Fish and another, $\frac{1}{4}$ oz., from surface workings ; Richards and Firby, 2 ozs. in two days and a-half," &c.

Subsequently there was an improvement :—"One party of three netted 28 ozs. in fifteen days ; another party of four, in eight days, in conjunction with an extra two for the last two days, have realized the enormous quantity of 63 ozs."

* The following were the regulations issued by command of His Excellency :—

"Colonial Secretary's Office,

"Melbourne, 18th August, 1851.

"With reference to the proclamation issued on the 16th instant, declaring the rights of the Crown in respect to gold found in its natural place of deposit within the Colony of Victoria, His Excellency the Lieutenant-Governor, with the advice of the Executive Council, has been pleased to establish the following provisional regulations, under which licenses may be obtained to dig, search for, and remove the same :—

"1. From and after the 1st day of September next, no person will be permitted to dig, search for, or remove gold on or from any land, whether public or private, without first taking out and paying for a license in the form annexed.

"2. For the present, and pending further proof of the extent of the gold deposits, the license fee has been fixed at one pound ten shillings per month, to be paid in advance ; but it is to be understood that the rate is subject to future adjustment, as circumstances may render expedient.

"3. The licenses can be obtained on the spot from the Commissioner, who has been appointed by His Excellency the Lieutenant-Governor to carry these regulations into effect, and who is authorized to receive the fee payable thereon.

"4. No person will be eligible to obtain a license, or the renewal of a license, unless he shall produce a certificate of discharge from his last service, or prove to the satisfaction of the Commissioner that he is not a person improperly absent from hired service.

"5. Rules adjusting the extent and position of land to be conveyed by each license, for the prevention of confusion, and the interference of one licensee with another, will be regulated by the Commissioner of Crown Lands who may be appointed to each locality.

"6. With reference to the lands alienated by the Crown in fee simple, the Commissioner will not be authorized for the present to issue licenses under these regulations to any person but the proprietors, or persons authorized by them in writing to apply for the same.

"By His Excellency's command,

"(Signed) W. LONSDALE."

The effect of the regulations promulgated by the Government was not foreseen. As soon as it was attempted to enforce them the diggers left the discovered goldfields. Tents were struck, horses were harnessed, and men hurried off to remote gullies and far-off hills, in order to escape the eyes of the Commissioners; and in this way many new discoveries were made. Determined to find the means of existence by gold mining if possible, and stimulated by the prospect of large profits, they eagerly sought and examined new country, and succeeded well; and they accomplished also the minor object—that of evading payment of the license fee. At Ballaarat, however, the field was too rich to be abandoned by all. Getting gradually accustomed to the kind of work to be done, and gaining experience day by day, the miners reaped a good harvest, and surely had no reason to complain of the license fee. One man washed 32 ozs. from a tin-dish-full of earth, and seven men got $\frac{1}{2}$ cwt. of gold in two days.

At the end of September, 1851, there were 567 men on the Ballaarat goldfield; they had 143 cradles; and it was estimated that each man was getting, on an average, 1 oz. 6 dwts. 2 grs. per diem.

The following extract from the *Argus* of the 3rd October, 1851, shows the nature of the change which had come over the population:—

The report of the correspondent at Geelong contains the following:—"Wages are rising; common necessities of life are rising; wood and water are rising. There is no appearance of the demand for labor for our shearing and harvest being supplied; even if a constant stream of immigration sets in immediately, it will benefit us far less than many expect * * *. The police force are handing in resignations daily; even the sergeants are leaving. The custom house hands are off to the diggings; seamen are deserting their vessels; tradesmen and apprentices are gone; their masters are following them; contractors' men have bolted, and left large expensive jobs on their hands unfinished. What are the contractors to do? Why follow their men, and off they go. Patients, in becoming convalescent, forget the attention of their doctor, and his kindness in bringing them round, and depart without ever wishing him good-bye; the doctor must of course follow; and the lawyer, on the same principle, follows his clients; and all agree that Ballaarat is the only place where there is a possibility of squaring off old accounts, by coming down with the dust."

In his next report, dated the 4th October, he says:— * * * "It is the intention of two captains at present here to proceed to the diggings at once and satisfy themselves of the truth of the astounding intelligence that continues to pour in; and if they find there is no exaggeration, they intend immediately on their return to moor their vessels snugly and start with their crews to the diggings."

About the middle of October a great many persons returned to Melbourne. They had attempted to dig for gold; but they disliked the labor, and were disappointed with the results. Instead of getting gold by some easy method, as they supposed was possible, they found that they had to work for it; and then, as now, this class preferred idleness in Melbourne to steady employment in the country. They complained bitterly of the hardships and privations; and doubtless the wet holes, the severe labor, and the ill success of such as were wholly inexperienced in digging and washing auriferous earths, were sufficient to deter them from the further pursuit of the business.

The statements made by persons who returned, dismal as they were, but imperfectly described the realities of the situation. Men had forsaken their ordinary avocations; the shepherd had left his flock, the driver his team; lawyers had forsaken the courts, the merchants the counting-houses, the clerks their desks; and field

laborers and artisans had departed without warning. There was no prospect of finding men to reap the crops; and it appeared certain that a famine was impending. Absorbed in the pursuit of gold, all domestic and public and general duties were forgotten. And while it was thought certain that the miners would suffer severely from the want of provisions, there came amongst them a thing more terrible than famine. Crime flowed in amongst them as a strong stream. It became known that Van Dieman's Land had emptied itself, and that the flood was pouring into Port Phillip. Men walked warily in the day-time, and fortified themselves at night. Each prepared himself for an encounter which he deemed inevitable; and those who had accumulated gold never went to sleep without the dread of being awakened by a savage murderer. But for the prompt action of the Government—the wise and careful forethought of an intelligent administrator, whose courage and ability deserve acknowledgment—it is certain that a repetition of the atrocities which disgraced California would have been seen in our colony. The police, organized not without difficulty, soon made their presence felt in the districts where were located the murderers who had been attracted to our shores; and the receipt of great quantities of provisions and stores relieved all anxiety as to the manner in which the miners would be supplied with food and clothing.

On the 5th November, 1851, the correspondent of the *Argus* reported that Ballaarat was nearly deserted. All the miners were leaving for Mount Alexander. Hundreds forsook rich claims in the hope that they would find more valuable spots at Forest Creek. The roads leading out of Ballaarat were crowded with pedestrians and carts and wagons. Carriers got from £25 to £30 per ton for conveying luggage; and cradles and mining implements were sold at the old diggings for a few shillings.

The following estimate of the quantities of gold obtained was published on the 19th November, 1851:—

	Ozs.
In Melbourne banks - - - - -	27,000
In Geelong banks - - - - -	15,000
In private hands, Melbourne - - - - -	5,000
In private hands, Geelong - - - - -	3,000
In the hands of diggers on the goldfields, or on the road - - - - -	17,000
	67,000

This quantity, it was stated, had been got in less than two months. The value of the total quantity of gold shipped from Sydney up to the 4th November, 1851, was estimated at £218,940, the result of active operations during a period of more than six months.

The surface and shallow workings at Forest Creek were undoubtedly very rich. Three persons got, in nineteen days, 360 ozs. of gold; one party of five washed 2½ lbs. in one day; another party of four weighed 11 ozs. as the produce of their labor from morning until three o'clock in the afternoon; and another set of three got £1,000 worth of gold in fourteen days. A great many, however, were unsuccessful. They knew not where to sink; and as hopefully put down a shaft on the side of the hill as in the valley, and as carefully washed the slate as if it had been auriferous earth. Much unprofitable work had the effect of discouraging them finally; and they gladly accepted employment for wages at the rate of £1 per week with rations. Still they were in a measure independent. They had hopes; they were learning the art of gold mining by

conversing with successful men and by watching their operations; and they were willing to try again; and if the employer did not wear a pleasant countenance, or was so unreasonable as to issue instructions, they took up their blankets and left him.

On the 27th September, 1851, the escort from Mount Alexander brought 10,428 ozs. of gold to Melbourne, and left about 6,000 ozs. on the diggings; and about 1,500 ozs. were received from Ballaarat.

Fresh regulations were issued by His Excellency the Lieutenant-Governor, on the 1st December, 1851, and the license fee was raised to £3 per month.*

This code evoked remonstrances; and something like co-operation amongst the great body of miners was for the first time apparent. Thousands of men assembled, and with some decency and order passed resolutions condemnatory of the action of the Executive.

Late in November the miners passed the great mass of granite which separates the goldfields of Castlemaine from those of Sandhurst, and they succeeded in finding gold in the Bendigo Creek, and rapidly opened up a considerable tract of rich country. There, and at Castlemaine and Ballaarat, large meetings—some attended by 14,000 persons—were held, and protests were made against the payment of the fees.

In view of these circumstances, the Government issued a notice rescinding the regulations dated the 1st December, 1851.†

The miners, however, were not satisfied. Discontent and uncertainty prevailed; but the better class worked hard and paid the fees, and did not trouble the Government.

Little reliance can be placed on the estimates of the quantities of gold raised when the goldfields were first opened. There was disorganization everywhere; and

* "*Licenses to Dig and Search for Gold.*"

"Colonial Secretary's Office,

"Melbourne, 1st December, 1851.

"With reference to the proclamation of the 16th August last, and to the provisional regulations of the 18th of the same month, relative to the issue of licenses to dig and search for gold, His Excellency the Lieutenant-Governor, with the advice of the Executive Council, has been pleased to promulgate the following additional regulations:—

- "1. The license fee for one month, or the greater portion of the month, will be three pounds.
- "2. Any person who may arrive on the ground, and apply for a license on or after the 15th of any month, will be charged half the above fee.
- "3. All persons at the goldfields who are in any way connected with the search for gold—as tent-keepers, cooks, &c.—will be required to take out a license on the same terms as those who are engaged in digging for it.
- "4. The above regulations will take effect from and after 1st January, 1852, and continue in force until cancelled by any subsequent regulations.

"By His Excellency's command,

"(Signed) W. LONSDALE."

† The notice was as follows:—

"Colonial Secretary's Office,

"Melbourne, 13th December, 1851.

"Measures being now under the consideration of Government which have for their object the substitution, as soon as circumstances permit, of other regulations in lieu of those now in force, based upon the principle of a royalty leviable upon the amount of gold actually raised, under which gold may be lawfully removed from its natural place of deposit: His Excellency the Lieutenant-Governor, with the advice of the Executive Council, hereby causes it to be notified that no alteration will for the present be made in the amount of the license fee as levied under the Government notice of the 18th August, 1851, and that the Government notice of the 1st instant is hereby rescinded.

"By His Excellency's command,

"(Signed) W. LONSDALE."

the influx of immigrants was so great, the demands on all departments so heavy, and the difficulty of finding competent persons to perform even the most pressing duties so much increased by the sudden changes which had occurred, that it is not a matter for astonishment that but little attention was bestowed on questions at that time of inferior importance.

It appears that only 145,146 ozs. were exported during the year 1851; but an estimate of the quantities actually obtained up to the 20th December, 1851, was reported in the newspapers of the day to be as follows:—

	Ozs.
By escorts, from the 19th November to the 17th December -	85,061
Estimated to have been brought by private conveyances -	28,353
Supposed to be in the hands of miners on the goldfields -	80,000
In the banks—Melbourne and Geelong - - - -	42,000
In private hands - - - - -	8,000
	243,414

Notwithstanding that ill-feeling and dissatisfaction prevailed on the goldfields,* the miners continued their explorations with spirit and industry.

Bathurst—though at that time presenting great temptations—failed to withdraw very many from the certain riches which were within their grasp at Ballaarat, Forest Creek, and Bendigo.

If not successful at any of those places (and many met with no success, or such poor results as to reduce them to the verge of starvation), they either sought employment or wandered through the silent forests, sinking shafts here and there, until they discovered a new field. Ararat, Dunolly, and the Ovens, one after another, were thus prospected, and the auriferous tracts in those localities soon attracted thousands.

In a short time all doubts as to the great extent and productiveness of our goldfields were removed, and everywhere activity and liveliness characterised the proceedings of traders, builders, and landowners.

During the year 1852 the miners raised 2,218,782 ozs. of gold, equal to £8,875,128; and in 1856 the yield was as high as 2,985,991 ozs., or £11,943,964.

Unlike most other countries where gold mining is the principal industry, the measure of our success is not to be gauged by our exports. Immense sums have been expended in this country in the construction of roads, railways, and other public works. Large towns with fine buildings, good streets, and parks and gardens, well lighted, and supplied with water from reservoirs of great extent, show that no small share of the wealth the mines have yielded has been profitably used in turning the wilderness into a habitable abode. Where but a few years ago the solitary shepherd earned a scanty meal by protecting the flocks of the squatter—where the wild dog howled and the emu stalked in quietness—where the kangaroo listened and heard no

* This state of feeling continued to exist, until at last serious disturbances occurred at Ballaarat. It was not until a commission, consisting of William Westgarth, Esq., M.L.C., Chairman, John Pascoe Fawcner, Esq., M.L.C.; John Hodgson, Esq., M.L.C.; John O'Shanassy, Esq., M.L.C.; James Ford Strachan, Esq., M.L.C.; and William H. Wright, Esq., Chief Commissioner of Goldfields, had taken evidence on the goldfields, and thoroughly investigated the condition of the miners, and reported to His Excellency Sir Charles Hotham, that a commencement was made in practical legislation, having for its objects the advancement of mining, the improvement of the position of the miner, and the collection, by methods least likely to be burdensome, of reasonable fees for the privilege of mining on Crown lands. The commission made their report on the 29th March, 1855.

noise to frighten him—where the wild pigeon and the parrot made their nests—we hear now the sea-like roar of hundreds of stamp-heads, and see the hills stripped of their trees, the streams diverted from their natural beds, and villas and wide streets, and tall chimneys and churches and theatres. If there has been a profuse outlay, it has not been that of the spendthrift, but rather that of the wise, enlightened, and mayhap too liberal landlord, who delights in beholding his fields in a state of high cultivation, and the villages in his neighborhood neat and well kept and orderly.

Some idea of the changes which have been effected since gold was discovered in the colony may be gathered from the following figures. In 1851 the population was as follows:—

Males	-	-	-	-	-	-	-	-	-	46,202
Females	-	-	-	-	-	-	-	-	-	31,143
Total number of persons -										77,345

The number of acres under cultivation was only 57,472, and much of the colony was wholly unoccupied.

The imports were £1,056,437, and the exports £1,422,909; the gross revenue was £392,455, and the gross expenditure £410,864. Compare these figures with those for 1867:—

Population—Males	-	-	-	-	-	-	-	372,239
Females	-	-	-	-	-	-	-	287,648
Total number of persons	-	-						659,887

£										
Imports	-	-	-	-	-	-	-	-	-	11,674,080
Exports	-	-	-	-	-	-	-	-	-	12,724,427
Gross Revenue (estimated)-	-	-	-	-	-	-	-	-	-	3,210,504
Gross Expenditure (estimated)	-	-	-	-	-	-	-	-	-	3,368,536

Number of acres under cultivation, 631,207.

The estimated gross value of rateable property in the corporate towns and boroughs for 1867 is £20,394,918. The revenues of these towns and boroughs is £335,606, and the expenditure £322,534.

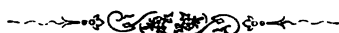
Add to this the estimated total value of rateable property in shires and road districts, £21,536,097, and some accurate conception may be formed of the rapid progress of the country during the past seventeen years.

Not alone in these aspects are the results of a satisfactory character. The reader may refer to the valuable papers published by the indefatigable Registrar-General, Mr. W. H. Archer, for a complete, concise, and clear statement of our advancement in agriculture and manufactures, and what has been done by the Government in the interests of education and science and the arts.

The few figures which I have extracted from his tables may perhaps induce those who feel an interest in the colony to refer to the pages of Mr. Archer's *Statistical Essay on the Progress of Victoria*, which is full of valuable information, carefully collected, and illustrated by many useful tables relating to population, mortality, occupations of the people, religions, revenue, and finance, as well as many new facts concerning the physical geography and climate of the colony.



Movements of the Population on the Goldfields.



The discovery one after another of many rich goldfields was not at first altogether beneficial to the individual miner. Exaggerated accounts of the wealth to be obtained at new and distant places kept men's minds in a fever, and only a few were able to resist the temptations presented to them. Thousands of them rushed from one point to another in the vain hope of making a fortune in a few days.

Repeated disappointments did not discourage them. Want, weak health caused by want, rough weather, long journeys, the wildest and worst tracks, did not deter them from entering on new enterprises. Moderate remuneration, the probability of finding a home, the society of friends or acquaintances, the ease and comfort belonging to a life in the midst of a population well supplied with things necessary to a state of civilization, had no attractions for them; or, if they had, the temptations offered in remote and unexplored districts overbore them.

As long as the miners confined their wanderings within the boundaries of the colony few complaints were made, and the distress and suffering were not of such a character as to be beyond help; but when they left Victoria the circumstances changed. Towards the end of July, 1858, it was reported in the Sydney newspapers that a very rich goldfield had been discovered near Port Curtis. It was said that several nuggets had been got at Corroona, on the Fitz Roy River, and that an eminent geologist had seen them, and *had pronounced most favorably of the indications, and had stated that the specimens gave almost certain promise of a much higher degree of productiveness than is usual.* Fed by rumors of this kind, and without the warrant of facts which sober thoughtful men would have required, thousands of miners hastened to the spot. The idle and the industrious, the thriftless vagabond and the steady hard-working mechanic—giving but little heed to the consequences, and relying implicitly on vague statements—rushed to the new goldfield. In October as many as forty-five vessels sailed from Sydney for Port Curtis, and many of these carried Victorian emigrants. But when a crowd collected—when the ground was examined—when the exaggerated statements which had appeared in print came to be tested by the actual results as obtained by the pick and the tin-dish—the miners found that it was necessary to return. Gold had been discovered, but only in small quantities. The ground was hard, the sinking difficult, and the returns so small as to preclude the hope of maintaining an existence. Diseases caused by bad water and insufficient food and shelter shortly thinned the ranks of the deluded immigrants; and those who had means of escaping, and were not prostrated by sickness, lost no time in getting away. A great many, however, were too poor to pay their passage back; and many lives would have been sacrificed if the Government had not stepped in and provided means for the relief and removal of the destitute.

In December, 1858, the last vessel freighted with disappointed diggers left Port Curtis for Melbourne; and it was expected at that time that the severe lesson thus taught to multitudes would not be without its use.

This was a mistake.

In 1860 a large number of industrious adventurous men left Victoria for a new goldfield in New South Wales. Lambing Flat was for a considerable period even more attractive than Port Curtis. Fortunately it was not very far off; and when the riots commenced the more respectable amongst the Victorian miners returned to their homes. But the sister colony profited somewhat by the discovery. Some of our miners never came back.

Early in the same year some persons found gold in the upper part of the basin of the Snowy River, and within the confines of New South Wales. On the 20th February, 1860, it was announced that 4,000 ozs. of gold had been raised; and, a few days after, reports of the discovery of a nugget weighing 140 ozs. and of claims yielding 120 ozs. per week were circulated everywhere. Telegrams containing news of a very exciting character, official reports, and statements of the results of the analyses of the gold, were so framed as to unsettle the minds of the Victorian miners on every goldfield; and again a great many men left good claims in Victoria to try their fortunes in new fields. Miners, to the number of 10,000 or 12,000, assembled rapidly; and, as the country is nearly everywhere auriferous, a considerable quantity of gold was got in a short time. But soon the cold weather set in—snow fell on the mountains, provisions became scarce and very dear—and once more destitution overtook the adventurers. They left Kiandra, but not to settle elsewhere. They returned to Victoria, only to wait for the announcement of some new discovery. That it should be far off, that the statements respecting it should be highly colored, that proof of every kind should be wanting, that hardship and suffering should be placed before them—seemed indispensable; and very soon all these conditions were fulfilled.

On the 28th July, 1861, the barque *Dunedin*, from Lyttelton, New Zealand, arrived at Newcastle (New South Wales), and brought intelligence of the discovery of gold at Tuapeka. The Chief Surveyor reported that one party, consisting of three men, had obtained in fourteen days about 112 ozs. of gold, and that several persons had had the like success.

Further intelligence soon reached Victoria. It was said that the miners generally were getting gold, but that the roads from the shipping place to the goldfields were in a fearful state, and that flour was sold to the diggers at the rate of £150 per ton.

By the end of September, 1861, it was estimated that 10,000 miners had left our shores; and at that time every vessel laid on the berth for New Zealand was besieged by anxious men, who were bent on seeking their fortunes in the new country. Many of our miners, who had previously been obtaining from £4 to £6 per week, sold their claims and appliances to Chinamen and others for just such sums as would enable them to pay their passage to New Zealand.*

According to the returns published by the Government, it appears that 13,255 persons arrived in Otago during the fifteen weeks preceding the 25th October, and those who departed numbered only 1,500.

Profitable goldfields were opened. A great many miners succeeded in finding gold; but the great cost of provisions, the inclemency of the weather, the want of shelter, the difficulty of procuring firewood even sufficient for cooking their food, and

* *Mining Surveyors' Reports*, September, 1861, p. 396.

the wetness of the ground, very soon turned the minds of the immigrants towards the country they had so hastily forsaken.

At this time it was proposed that the Government of Victoria should send vessels to Dunedin to bring back the people who had so foolishly abandoned our goldfields for the inhospitable mountains of New Zealand. But wiser counsels prevailed. The people were in no danger of starvation. They had left voluntarily, and it was thought right to let them make the best of the circumstances in which they found themselves.

In 1858 the population of Otago was 6,944; and in 1865, during a period of only eight years, it had increased to 46,599, of whom 29,179 were males.

The gold exported from the Province of Otago is, according to official returns, as follows:—

	Ozs.
1861	187,695
1862	397,602
1863	580,233
1864	455,927
1865	253,699
1866	162,477
1867	149,364
1868 (to 30th June)	79,260
	2,266,257*

This is rather more than the yield for the past eighteen months of the gold mines of Victoria.

There is, undoubtedly, much room for industrious miners in New Zealand. The hardships are many, but the ground is rich, and it will continue to furnish supplies of gold for a long period. The valleys in New Zealand have been deeply eroded. In Victoria we find *leads* of gold much below, or nearly on a level with, or but slightly elevated above, the modern streams; but in such places as Hokitika they are at a considerable height above the existing streams; and as the rivers have cut through several auriferous strata, there are terraces in the basins; and there are still older *leads* on the bounding ranges partially eroded at the sides, and cut into by streams running at right angles to them, rendering it difficult in many parts to trace them.

The more modern drifts as little resemble the drifts of Victoria. The fluvial action in New Zealand during the tertiary period (if not previously) and in recent times was more energetic than in Victoria; and the experience gained by our miners was of little use to them when they marked out claims at Tuapeka or Hokitika.

Many amongst the hardy and strong-hearted men who opened gold mines in California, New South Wales, Victoria, and New Zealand are not able to withstand the attractions of new fields. They work hard, but they are restless and always ready to undertake hazardous adventures.

* "Since the date of Mr. Reid's discovery, there have been exported from New Zealand, 2,252,359 ozs. of gold, the produce of Otago, valued in round numbers at nine millions sterling.—(*Customs Returns, New Zealand Gazette, May 7th, 1868.*) This return only includes exports to 31st March, 1868, since which period, to the present date (June 10th), the exports have brought down 30,124 ozs. from the goldfields. * * * * * The present production of gold may be estimated at the rate of about 12,000 ozs. per month." *The Province of Otago in New Zealand: published by the authority of the Provincial Government, 1868.* This statement, it may be presumed, is accurate.

The Europeans who were attracted to this colony by the gold mines were not all accustomed to hard labor; and some were ready to leave the pursuit of gold mining for any remunerative employment of a different kind, and there were others who only followed gold mining in the hope of getting enough money to enable them to start some business or to engage in farming. Professional men, artisans, and skilled workmen, though perhaps preferring a life of independence, were gradually withdrawn from the goldfields by the chances of wealth and opportunities of preferment which the changeful character of a new and rising country always offers.

Thus it has happened that, from various causes, the number of miners has been reduced from year to year; and it is a matter for surprise that the yield of gold has not diminished in the same proportion. Now that the industry has assumed a settled character—that capital is available, and large enterprises undertaken with confidence, and good wages are to be got everywhere by industrious and skilful men—it is probable that we shall soon see some change for the better in the numbers employed. It is not unlikely that the numbers will continue to decrease for a few years; but as soon as labor becomes cheaper—as soon as young persons are sent to perform work suitable to them in the several operations connected with quartz mining—the numbers will increase. Those, too, who hang about the towns in idleness may perhaps take heart again, and go out into the ranges, where thousands of acres of rich auriferous lands are lying ready for them.

If they could make up their minds to bear a small part of the suffering which all bore without murmuring in 1851, 1852, and 1853, there would soon be a notable increase in the yield of gold.

In the early days of the goldfields delicate men, who had handled no heavier thing than a whip or a pen, went boldly to the mines, and they slept under thin tents, dug holes, washed earth, and prospered or suffered without complaint; and it is unreasonable to suppose that those who have become accustomed to life in the bush would fare worse, or have fewer chances of success, than the raw immigrant who came here sixteen years ago. The difficulties and dangers which attended exploration at first do not now present themselves; and it cannot be said with truth that gold mining at the present time is not a better occupation than very many which are eagerly embraced in the large towns.

The fact that an industrious man can earn from four to twenty shillings per diem by washing even the poorer auriferous earths will always have its effect on the labor market; and though this may stand in the way of many beneficial enterprises of a different kind, we should not murmur because our country is so rich.

Though there are many who are not to be restrained from wildly rushing from one goldfield to another whenever any exciting intelligence is published, the bulk of the miners is bound by ties which cannot be lightly broken. A great number of them have made comfortable homes, and they have good claims or steady employment; and the opportunity of satisfying the earth-hunger, which is ever predominating in the minds of men who have been, in respect of this appetite, starved in the old countries of Europe, is always before them. The more restless wander from one spot to another, and from time to time make valuable discoveries. And the effect of these does not cease when the gold is extracted.

If gold is discovered anywhere in considerable quantities, from 3,000 to 4,000 men very soon assemble on the spot. The place is well prospected, streets are laid off, stores built, and public works of one kind or another undertaken; and, when the

alluvial ground is all taken up, a few examine the ranges and discover quartz reefs. If they are successful (and there is no goldfield in Victoria where there are not some tolerably good reefs, though they may not always be wrought), machinery is erected, reservoirs constructed, and races cut. Employment at good wages is given to some; and gradually a population settles in the vicinity. In a short time fields are enclosed, the plough is set to work, and the wild bush is converted into farms and gardens. Perhaps only a few of those who rushed to the spot remain as permanent residents; but the nucleus of a town is established; and around it grow a municipality, order, and a measure of prosperity.

It is in this manner that Victoria has prospered, and is likely to grow wealthier from year to year.

It is somewhat interesting to examine the causes which have influenced the movements of the population on the goldfields.

In 1851 there were in the colony only 37,343 males above the age of twelve years, but when the goldfields were opened the numbers increased rapidly. In 1854 there were 144,883 males, of whom 65,763 were engaged in gold mining. In 1858 there were 223,604 males above the age of twelve years, of whom 147,358 were miners—the greatest number ever employed in this pursuit in the colony. Since that period the numbers have slowly decreased.

The goldfields attracted thousands from the neighboring colonies, from Europe, and from China. We had at one time nearly 40,000 Chinese miners in the colony.

At the present time (30th September, 1868) the numbers stand thus:—

	Alluvial Miners.		Quartz Miners.		Total.
Europeans	-	33,073	-	14,595	47,668
Chinese	-	15,756	-	58	15,814
Totals	-	48,829	-	14,653	63,482

Leaving 190,135 males above the age of twelve years who are engaged in other pursuits than gold mining.

As already stated, we have lost some 10,000 miners by the rush to New Zealand; probably not less in the aggregate than 5,000 by the several rushes to New South Wales and Queensland; but by far the greater number of those who have abandoned gold mining and remained in Victoria, have found profitable employment. Our most important public works—the railways—rapidly withdrew great numbers from the mines.

The Geelong and Melbourne Railway, commenced in September, 1853, gave employment for some time to about 1,300 men; the Melbourne and Sandhurst line, commenced in June, 1858, absorbed the labor of about 4,000 men; the Geelong and Ballaarat Railway, constructed during the years 1858–62, took away about 2,500 men; and the Echuca line, commenced in 1862, about 1,000 men.

The public works in the several municipalities and road districts, the suburban lines of railway, and works for water supply, have all served to withdraw great numbers from the goldfields; but many will consider that those who have forsaken mining for agriculture, gardening, trades, and other occupations more in consonance with their previous habits, have better promoted the interests of the colony than if they had remained on the goldfields. Indeed, when one looks at the country in those places where the miners have acquired property, and have improved their lands, there is little room for regret that the exports of gold are diminished by the changes (more particularly in the Land Laws) which have been effected by Parliament.

Of the Chinese miners it is estimated that 20,000 have left the colony never to return.

Laborious, economical in their habits, and without the temptation to expend their hard-earned savings in a strange land, it is probable that they have carried much treasure to their own country.

The figures given here are to be looked upon as only rough statements. No account is taken of the small numbers who have immigrated since 1858, with the intention of trying their fortunes on the goldfields, nor of the young persons born on the goldfields, who are now men able to labor; but the broad facts will perhaps be the more intelligible stated in this way than if a more complete analysis had been made.

There are other changes, however, to be taken into account when we endeavor to measure the producing power of the miners. It should be remembered that those who came to the goldfields in 1851, 1852, 1853, and 1854 were young men, or men in the prime of life. The lapse of time has not been without its effect on those persons. The young men are now middle-aged; and many of the older amongst the first immigrants are almost unfit for the severe labor which they once cheerfully performed.

The gold mines need a fresh supply of young and able men; and if the poor, ill-paid colliers and miners at home could come here, they would soon enrich themselves and benefit the colony. But the great distance, the cost of the voyage, the extraordinary accounts of Victoria that are current at home—and no doubt believed by millions—all operate to prevent immigration on a large scale. It is vain to show that the miners and artisans of this colony are in better circumstances, of a better class, more orderly, more industrious, and altogether steadier in their habits than their brethren in the United Kingdom. Those who could speak with authority in the mother country are silent; and those who are not well informed, or hostile to us, are eloquent; and therefore the more it becomes us to be patient.



Modes of Occurrence of Gold.



Gold is found in quartz veins, and in the rocks which these veins intersect, and in the *detritus* and *débris* which ancient or modern streams have deposited in the gullies and creeks.

Crystallised; as twisted threads; in thin plates; in bright spangles; in leaves as thin as the thinnest gold leaf; interleaved between crystals of quartz; within large transparent hexagonal crystals of quartz in moss-like aggregations; in small particles associated with iron and copper pyrites; in shining flakes and ragged lumps in green and blue carbonates of copper; in lumps with rough edges and many strings in the centre of masses of stibnite and valentinite; in microscopic flakes disseminated through hard dense quartz; and in large nuggets of great weight both in the veins and in the alluviums—we find gold in Victoria.

The crystals occur "from a pin's head to a pea in size; and their forms are principally the cube, modified by small planes of the octahedron and rhombic dodecahedron; and these are often tabularly compressed—the rhombic dodecahedron, as ground figure, with replacements by the cube; and more rarely the plain octahedron; and the octahedron with small faces of the cube. * * * * * Some are highly modified, exhibiting, as ground figure, the octahedron with small planes of the cube, rhombic dodecahedron, trapezohedron, tetrahexahedron, and hexoctahedron. Compound crystals are rare."*

It is said that a hexagonal crystal of quartz has been found enclosing a crystal of gold, but the writer has not yet had an opportunity of inspecting the specimen. It is in the possession of Mr. James Dawson.

Gold is found in veins traversing granite and diorite and in the granite itself. It has been detected in the planes of bedding of soft yellowish and reddish-brown silurian claystone, and in sandstone. It occurs in bluish-white plastic silicates in the veins; in the alluviums and also in the veins with carbonate of lime, oxyd of manganese, and carbonate of manganese; and, rarely, with sulphate of barytes. It has been got from the silurian, the mesozoic, and the miocene rocks, as well as from the pliocene deposits and the soils derived from the breaking up of slates and sandstones.

It is perhaps correct to say that it is never pure. We find at St. Arnaud and near the Goulburn gold and silver alloy; and neither the gold found in the veins nor in the alluviums is without some admixture of other metals.

Smooth boulders of quartz enclosing quite large pieces of gold are found occasionally in the deep *leads*, and the gold takes the general form of the boulder—the mass presenting a regular outline. In the auriferous stratum of the *leads* are found also native copper and native lead—as flattened grains, nuggets, and irregular pieces,

* Mr. Geo. H. F. Ulrich, F.G.S.

with fine particles of gold adhering to them; and rolled fragments of sulphide of antimony occur also (rarely) in the *washdirt*.

Pieces of fossil wood, highly mineralised, which have been taken from the deeper mines, as well as wood used for supporting the drives (where it has remained for some years), have exhibited, under the microscope, particles of gold adhering to and intermixed with crystals of iron pyrites all through the central parts of the wood.

At Avoca gold occurs in quartzite, and the pieces of the metal are generally not much water-worn. Jagged edges are common. The form of the particles of gold differs within small areas on the same goldfield; and gold got from goldfields far distant from one another presents characteristics which are obvious even to inexperienced persons. The form is governed by the character the gold bears in the vein, by the forces which operate in breaking up the vein and transporting the *débris*, and by the nature of the substances with which, during its transport, it is brought in contact. Gold may be carried some distance over a pipeclay bottom, where the fragments of rock borne with it are soft, without suffering much alteration in its form. Experienced miners are, however, often able to form useful conclusions as to the place of its origin when they study the form of the particles; and a quartz vein, underlying washdirt in a *lead* or a gully, is sometimes discovered by such indications. The gold found at Beechworth within granitic areas is generally in flat spangles, and that from the slate bed-rock is compact and cubical in shape.*

This subject is one which has engaged attention for many years; and experienced gold buyers and assayers often very quickly determine the character of gold, its fineness, and the locality from whence it has been brought, by a mere inspection. Trained to observe what others would neglect, they are not often deceived, even when deception is practised.

In their first and most obvious aspects, and dissociated from geological phenomena, the modes in which gold occurs in Victoria are simple enough. On the summit of a hill composed of silurian shales and mudstones we find a vein of auriferous quartz cropping out on the surface. Every piece that is broken off from the mass of hard dense vein-stone shows specks of gold; and the thin covering of earth near the reef and on the side of the hill is also auriferous. The bed of the gully trending from the ridge where the reef appears is composed of quartz gravel, clay, and sand, all derived from the older rocks; and throughout, but more abundantly near the surface of the bed-rock, these recent strata yield gold.

The several strata and the veins do not, however, everywhere present themselves in these simple forms. The erosive action of streams (and perhaps in some places ocean waves) has worn away the veins, and has caused a great thickness of sand and mud and clay to accumulate in the valleys. In many localities we find that the rocks which enclosed the auriferous quartz reefs, the reefs themselves, the streams which eroded them, and the *detritus* which they carried down to lower levels, have all disappeared; and we have to look for the gold in more modern accumulations, made up of the original rocks and vein-stones as well as the old drifts derived from those. Where the original ancient sedimentary rocks have been quite worn away the gold is found in the hollows in the granite on which the sedimentary strata once rested.

In other parts we find a regular succession of recent strata with several independent layers of auriferous drift lying one above the other, and the whole conserved by thin sheets of hard basalt.

* Mr. Peter Wright.

Under such circumstances the aid of the geologist is needed to observe the facts and to describe the features. When the first obvious appearances are no longer present, the modes of occurrence of the auriferous layers are somewhat complex, and not always easy of explanation.

Though the help of science is required to describe the phenomena, it is only just to the miners to state that, unaided, and in spite of the warnings of many scientific men, they have themselves brought to light nearly all the facts which fill this volume.

The following table,* drawn up by Mr. George Foord, the able metallurgist and analytical chemist, shows the average melting loss and fineness of the gold which is got in the several mines in Victoria:—

	Melting loss per cent.	Fineness of the resulting bar gold.		
		c. gr.	c. gr.	c. gr.
"Amherst - - -	2 to $3\frac{6}{10}$ -	23 2	to 23 $2\frac{4}{8}$	average 23 $2\frac{4}{8}$
Anderson's Creek - - -	— -	23	$1\frac{1}{8}$	
Ararat - - -	$1\frac{3}{4}$ to $2\frac{3}{4}$ -	23	$0\frac{4}{8}$ to 23 $1\frac{1}{8}$	
Avoca - - -	2 -	23	$1\frac{1}{8}$ to 23 $2\frac{3}{8}$	
Ballaarat - - -	$\frac{1}{4}$ to 3 -	23	$2\frac{3}{8}$ to 23 $2\frac{7}{8}$	
	(Average of good samples 1 per cent.)		(Mixed samples lower)	
Blackwood - - -	— -	23	0	
Buckland - - -	— -	22	$3\frac{6}{8}$	
Caledonia - - -	— -	23	$1\frac{1}{8}$	
Castlemaine - - -	$1\frac{7}{8}$ to $3\frac{2}{10}$ -	22	$3\frac{3}{8}$ to 23 $0\frac{1}{8}$	average 22 $3\frac{7}{8}$
	(Average $2\frac{1}{4}$)			
Chinaman's Flat - - -	— -	23	$2\frac{7}{8}$	
Coliban - - -	— -	22	$2\frac{3}{8}$	
Creswick - - -	$1\frac{1}{2}$ to $2\frac{1}{2}$ -	23	$1\frac{7}{8}$ to 23 $2\frac{3}{8}$	
Spring Hill - - -	2 to $2\frac{1}{2}$ -	22	$2\frac{7}{8}$	
Dunolly - - -	$1\frac{1}{2}$ to $2\frac{1}{2}$ -	23	$1\frac{3}{8}$ to 23 $2\frac{3}{8}$	
Gippsland District:—†				
Shea's Point - - -	$2\frac{3}{4}$ -	20	$3\frac{5}{8}$	
Dry Gully - - -	$3\frac{1}{2}$ -	20	$3\frac{3}{8}$	
Lower Creek - - -	$2\frac{1}{4}$ -	21	$0\frac{4}{8}$	
Swift's Creek - - -	2 -	21	$2\frac{3}{8}$	
Boggy Creek - - -	1 -	23	$1\frac{1}{8}$	
Gibbo Creek, near				
Mitta-Mitta - - -	$2\frac{3}{4}$ -	21	$0\frac{4}{8}$	
Goulburn - - -	— -	23	$0\frac{2}{8}$	
New Rush - - -	— -	22	$0\frac{7}{8}$	
Frenchman's Gully - - -	— -	23	$0\frac{4}{8}$	
Hell's Hole, Goulburn				
River - - -	— -	22	$0\frac{5}{8}$ to 22 $0\frac{7}{8}$	
Jones' Creek - - -	2 -	23	$0\frac{3}{8}$ to 23 $0\frac{6}{8}$	average 23 $0\frac{4}{8}$
Kilmore - - -	$2\frac{1}{4}$ -	23	0 to 23 $0\frac{6}{8}$	
Kingower - - -	— -	22	$3\frac{4}{8}$ to 22 $3\frac{6}{8}$	

* First published in *Fairfax's Handbook to Australasia*.

† Gippsland gold gets finer as the locality approaches the seaboard.

	Melting loss per cent.	Fineness of the resulting bar gold.			
		c.	gr.	c.	gr.
Korong - - -	$1\frac{1}{4}$ to $1\frac{1}{2}$ -	23	$1\frac{3}{8}$	to 23	$2\frac{1}{8}$
(Much higher in cases)					
Linton's (Smythe's Creek) $2\frac{1}{2}$ -	-	22	3		
(Armstrong's) $1\frac{3}{4}$ -	-	23	1		
Maryborough - - -	2 -	23	$2\frac{1}{8}$	to 23	$2\frac{7}{8}$ average 23 $2\frac{3}{8}$
White Hills - - -	— -	23	$2\frac{1}{8}$		
McIvor * - - -	$1\frac{7}{8}$ to $3\frac{1}{10}$ -	23	$0\frac{1}{8}$	to 23	$2\frac{7}{8}$ average 23 $2\frac{3}{8}$
(Average $2\frac{1}{2}$)		(Good samples)			
Mount Franklyn - - -	$2\frac{1}{2}$ -	22	$2\frac{1}{8}$		
New Bendigo - - -	— -	23	$1\frac{3}{8}$		
Ovens † - - -	$2\frac{1}{4}$ to $8\frac{1}{4}$ -	23	$2\frac{1}{8}$	(Lower when admixed with Goulburn or Omeo)	
Woolshed (fused) -	$1\frac{1}{4}$ to $2\frac{1}{10}$ -	23	$2\frac{1}{8}$	to 23	3 average 23 $2\frac{1}{8}$
Spring Creek - - -	— -	23	$2\frac{1}{8}$		
Nine-mile Creek - - -	— -	23	$2\frac{1}{8}$		
Three-mile Creek -	$3\frac{1}{4}$ -	23	$2\frac{1}{8}$		
Running Creek - - -	6 or less -	23	$2\frac{1}{8}$		
Pleasant Creek - - -	— -	22	$2\frac{1}{8}$	to 22	$3\frac{1}{8}$
Raglan - - - - -	— -	23	$1\frac{3}{8}$	to 23	2
Sandhurst - - - -	$1\frac{7}{8}$ to $2\frac{1}{4}$ -	22	$3\frac{1}{8}$	to 23	$0\frac{1}{8}$ average 22 $3\frac{1}{8}$
White Hills - - -	$2\frac{1}{4}$ -	23	2		
Epsom (dust) - - -	1 -	23	$0\frac{1}{8}$		
Taradale - - - -	— -	23	0		
Tarrangower - - -	— -	23	$0\frac{1}{8}$		

In genuine samples of alluvial gold, although the amount of melting loss will very much depend upon the care in cleaning exercised by the buyer, the fineness is pretty constant for each field, and will seldom deviate from the average mark more than a few eighths of a carat grain. With matrix gold, however, the case is very different; and samples from the same reef—even from the same claim—will often differ widely as to melting loss and fineness, according to the treatment in roasting and crushing. Matrix gold is usually lower than alluvial gold from the same locality; there are, however, exceptional cases. ‡

* Quality of McIvor gold gradually lowering.

† High melting loss due to tin oxide.

‡ The gold found in the drifts at Marong is said to be lower in quality than any other raised in the Sandhurst District. According to information furnished by Mr. Shires, the assayer for the Bank of New South Wales at Sandhurst, it assays 22·1, or at the highest 22·1 $\frac{1}{2}$, while the average of the alluvial gold at Sandhurst is 22·3 $\frac{1}{4}$. Many of the flats at Sandhurst yield gold of still higher quality.

Mr. Shires says:—"Taking the great valley of Bendigo, and beginning above Kangaroo Flat, and going down to Huntly, the fineness of the gold steadily increases from 22·1 $\frac{1}{2}$ to 23·2, and even higher. Again, so does the fineness increase from the town of Sandhurst onwards towards the Whipstick; and scarcely anywhere is gold found of the same quality from places even but a quarter of a mile apart."

Mr. Shires draws attention to the fact that, in some cases, the gold in the veins at the sources of the creeks assays as high as 22·3 $\frac{1}{4}$ to 23; and that the alluvial gold, presumably derived from these veins, is only 22·1. It might be supposed from this that the gold was not derived from the quartz veins. Perhaps not. Perhaps it may have been derived from adjacent slate reefs, in which we know very well there is gold in such quantities, in some places, as to remunerate the miner. But

As examples of the fineness of amalgam gold, the following may be quoted :—

	c.	gr.	c.	gr.	c.	gr.
Mariner's Reef, Maryborough *	-	-	23	$2\frac{1}{8}$ to $23\frac{3}{8}$		
Whitehorse Reef, Maryborough †	-	-	22	$3\frac{1}{8}$		
Simmons' Reef, Mount Blackwood ‡	-	-	23	$0\frac{3}{8}$ to $23\frac{1}{8}$		
Mount Gold, Castlemaine	-	-	23	$0\frac{3}{8}$		
Tarrangower, Eaglehawk	-	-	23	1		
Tarrangower, Beehive Reef	-	-	23	$0\frac{3}{8}$		
Tarrangower, Nuggety Reef	-	-	23	$0\frac{3}{8}$		
Ballaarat, amalgam gold	-	-	22	$2\frac{1}{8}$ to $23\frac{0}{8}$		
Avoca, amalgam gold	-	-	22	$3\frac{3}{8}$ to $23\frac{0}{8}$		
Mount Franklyn, amalgam gold	-	-	20	$1\frac{1}{8}$ to $23\frac{2}{8}$		
Mount Franklyn—the fineness usually						
ranging between	-	-	22	$2\frac{3}{8}$ to $22\frac{3}{8}$		
Sandhurst, quartz gold	-	-	21	$2\frac{1}{8}$ to $23\frac{0}{8}$	average	$22\frac{3}{8}$
Coliban, amalgamated	-	-	22	$3\frac{1}{8}$		
Amherst, amalgam gold	-	-	22	$3\frac{3}{8}$ to $23\frac{2}{8}$		
Amherst, usual fineness from	-	-	23	$1\frac{1}{8}$ to $23\frac{2}{8}$		
Steiglitz, amalgam gold	-	-	17	$2\frac{1}{8}$ to $22\frac{2}{8}$	average	21 2
Goulburn, amalgam	-	-	17	$0\frac{3}{8}$ to $23\frac{1}{8}$		
Goulburn, usual from	-	-	21	$2\frac{3}{8}$ to $23\frac{1}{8}$		
Korong, amalgam	-	-	22	$2\frac{1}{8}$ to $23\frac{1}{8}$		

The melting loss of amalgam gold varies between $\frac{1}{4}$ and 15 per cent."

That the operations of the gold miner, as they are conducted in Victoria, may be the more easily understood, it is necessary to describe the several modes of obtaining gold and the special conditions under which the metal occurs.

And the history of gold mining in this colony is told when we narrate the facts connected with the methods used in the extraction of the metal. §

it should be remembered that the alluvial gold has been derived, most probably, from a great vertical extent of vein-stuff which has disappeared, and respecting the contents of which we know nothing, and that, therefore, it cannot fairly be put in comparison with the gold occurring in veins *in situ*. We know next to nothing of the contents of the veins which have been denuded.

Mr. C. Lort Smith, the gold buyer for the Bank of Australasia at Sandhurst, says that the best of the Marong gold only reaches $22\frac{1}{8}$, and the worst is $22\frac{1}{8}$, the rest being $22\frac{1}{8}$ and $22\frac{1}{8}$. The quality of the gold in the various gullies differs but little. He observes that the Epsom gold is very fine—from $23\frac{1}{8}$ to $23\frac{1}{8}$, and some $23\frac{2}{8}$; and that *the finer the particles of gold everywhere* the higher the quality. This is particularly noticeable at Huntly, where coarse gold is $23\frac{1}{8}$, and the very fine particles $23\frac{1}{8}$ to $23\frac{2}{8}$.

* The highest known matrix gold—higher than Maryborough alluvial.

† Lower than Maryborough alluvial.

‡ Higher than Blackwood alluvial.

§ Gold was got in Egypt 2,000 years ago from veins of quartz in exactly the same way as our miners get it. The miners apparently followed the underlie of the veins, and excavated sloping shafts, and made galleries of great length. The workmen carrying lamps on their foreheads, dug and toiled under conditions which would not now be borne. The stone when taken out was pounded in mortars, washed on sloping boards, and the rich residuum treated, if with less metallurgical skill, certainly with ultimate results not much inferior to those now obtained.

Pliny's account of gold-mining operations in Spain might, with a few unimportant alterations, be accepted as a fair description of the methods of working some of our mines. Vein mining, the modes of washing auriferous earth, the system of races (some of them one hundred miles in length),

The following seems to be the most convenient division:—

First—*Surfacing*:—The washing of the thin covering of earth resting on the tops and sides of the hills in the close neighborhood of auriferous quartz veins.

Second—*Shallow Sinking*:—The obtaining *washdirt* from off the surface of the old claystones, sandstones, and slates, by sinking pits or making excavations in the valleys and creeks.

Third—*Sluicing and Hydraulic Mining*:—The washing of the auriferous earths, by streams of water, in the gullies and valleys where recent deposits of auriferous clays and gravels occur.

Fourth—*Deep Sinking*:—The obtaining auriferous earths by penetrating the deeper tertiaries.

Fifth—*Tunnelling*:—The obtaining auriferous earths and vein-stones by adits.

Sixth—*Quartz Mining*:—The obtaining gold from the mineral veins intersecting the older sedimentary rocks.

It is not the purpose of the writer to deal with any of these sections exhaustive of detail, because that would require, for the proper performance of the work, time and opportunities which he has not at command; but enough will be given, it is hoped, to stir up men's minds to a consideration of the important questions involved, and to incite those who have leisure and learning to devote their energies to labors which cannot result otherwise than profitably, both as regards the advancement of the interests of science and meaner ends.

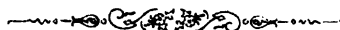
and the timbering of drives, were but little different from what may be seen now in many places in Victoria and California.

At every *rush* the miners are obliged very often to work in the same manner and to resort to the same contrivances for getting gold as were common in the times of Darius the son of Hystaspes (B.C. 521).

Comparing one epoch with another, and confining ourselves to the ordinary modes of occurrence of gold, there are few changes to note. And, as regards the laws, the ordinances of Ferdinand and Isabella contain paragraphs which are nearly word for word the same as occur in many of the statutes, mining bye-laws, and mining regulations which are now in force. Like difficulties call for the like remedies; and the sharp texts of the Spanish rulers have to be reproduced now to check irregularities of the same kind, and due to the same causes, which operated to the disadvantage of the miners four hundred years ago.



Surfacing and Shallow Sinking.



In the early days of gold seeking—before deep leads or quartz veins were discovered in the colony—the miner was content to wash the rich soils which lay on the slopes of the hills, and to follow the gold-bearing stratum thence to the flats. In the valleys he was obliged to sink shallow pits in order to get at the washdirt, which in such places is from two to thirty feet below the surface, deepening gradually towards the main stream.

The *washdirt* (i.e. the stratum containing the gold) was thrown into a tub and carefully and laboriously washed. The workman, holding a spade, kept stirring the stuff and adding water until the stiff clay was softened; the mud was poured out and more water added and more puddling done until the mass became fit for the cradle.* It was passed through this machine, and then the remaining clay, sand, and mud were carefully taken from the ledges and re-washed in a shallow tin dish, at the nearest pool, until the gold was left quite clean and pure in the bottom of the dish.

In *panning off* a good deal of ingenuity and much neat turning of the wrist are required to keep back the gold and to let the mud and gravel flow away in the waste water.

The earth which is taken from off the surface of the hills in the vicinity of auriferous reefs is in some places very rich. A patch twelve feet by twelve feet, and about a foot in depth, has yielded as much as 30 ozs. of gold, even by such rude processes as were used some fifteen years back; and far larger yields from smaller areas were obtained where the depth was not more than two or three feet.

A not inconsiderable proportion of the gold annually exported from Victoria is raised by European and Chinese miners from quite shallow ground; and, except that they have substituted the horse-puddling machine and the *long-tom* for the old tub and cradle, there is little change in the mode of raising the gold.

On new goldfields, indeed, the old appliances are still required. The miner is not able to carry machinery to a *rush*. His *impedimenta* must be as light as possible; and he has not time to make boxes and cradles when he arrives at the scene of operations. He marks out a claim, and, if he is a workman and not a "shepherd," he sinks a shaft as rapidly as possible, washes the stuff if it is of any value, and as soon as that is exhausted moves quickly to new ground. It is only after the field is developed, and men have had time to accumulate some wealth, that steam and horse puddling machines and races and sluices are brought into use.

* A small box shaped like a cradle, having a perforated sheet of iron at the upper end, and wooden shelves and ledges or riffles below. Many improved cradles have been invented since the first rude machine was brought into use.

Some of the old appliances (found yet in many places at the present time) carry back the mind to remote periods. For instance, the *Shadoof* of the Egyptians, as figured on the monuments, was until lately in common use on every goldfield. Comparing the drawing of a Hand Whip made yesterday (see Fig. 2) with that of the ancient Shadoof given by Rawlinson,* we note no change.

The following brief account of some of the yields of gold from the shallow diggings is intended to show the general character of the soils and thin strata in the vicinity of auriferous reefs. The examples have not been selected because the yields were unusually rich, but because they represent—as far as accurate information is obtainable—the past and present condition of the shallow alluviums in Victoria.

It has been stated that sections of such strata are not of much interest to the geologist—and generally speaking this is true—but to the miner they are highly valuable, and if we had had many of them illustrative of gold workings in other countries when our fields were first opened, much useless labor would have been saved, and much profitable prospecting would have been done quickly and intelligently.

That part of the Mining District of Ballaarat which lies to the south of the Main Spur of the Great Dividing Range is bounded on the west by a north and south line, extending from the source of the Emu Creek in the Main Spur to the sea-coast; on the south and south-east by the sea; on the east by the River Werribee and its tributary the Djerriwarrah Creek; and on the north by the Main Spur. The part lying to the north includes the upper parts of the basins of the Bullarook and Creswick's Creeks, and Clunes.

The principal goldfields are Ballaarat, Buninyong, Creswick, Clunes, Smythesdale, Blackwood, Steiglitz, and Gordon. Rich surfacing and shallow sinking are found at all these places, and auriferous alluviums in nearly every tract where the palæozoic rocks are exposed.

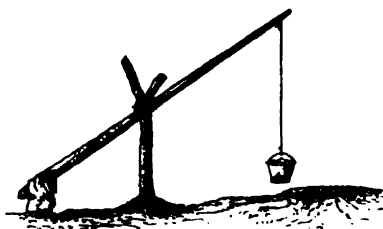
The deep *leads* at Ballaarat have of late years attracted so much attention that it has been almost forgotten that this locality was once as remarkable for the wealth obtained from the surface of the hills and the shallow gullies which have their sources in Whitehorse Range.

This goldfield will be described under the head of "Deep Leads." All the slopes and valleys which were so rich trend towards the *leads*, and in giving a history of them, and the facts connected with the discovery and development of them, it will be shown how, by reason of the great yields from the gradually deepening gullies, the miners were led to make costly explorations on the basaltic plateau.

The history of the *leads* at Ballaarat, compiled by Mr. Wood (see Appendix A), gives interesting information connected with every feature of mining in this locality.

The shallow diggings at Buninyong and Smythesdale much resemble those found at Ballaarat.

FIG. 2.



HAND WHIP.

* *The Five Great Monarchies of the Ancient Eastern World*, by George Rawlinson, M.A., p. 43, vol. IV.

The goldfields at Creswick may be said to have been discovered in March, 1850, when gold was found in Creswick's Creek, but it was not until September, 1854, that the great rush occurred. When it was at its height (December, 1854), the locality was visited by the Royal Commission appointed to enquire into the condition of the goldfields, and they reported very favorably on it. Though 20,000 miners were concentrated on a limited area there was scarcely a necessity for police protection. Order, quietness, and industry everywhere prevailed.

The shallow alluviums were in many places very rich. One party, when the field was first opened, took 145 ozs. from the bottom of their shaft, and where a rich patch was struck it was not uncommon to see 12 ozs. washed out of one tubful of dirt. There is a large area of shallow ground already opened in the immediate vicinity of Creswick, and there is plenty of work left to be done by persons who are content with moderate gains.

Gordon, which lies to the east of Ballaarat, and is distant from it about thirteen miles, is situate on the sources of the River Moorabool. The waste of numerous rich quartz reefs has filled some of the small gullies, and a good deal of gold is occasionally got from them.

In All Nations Gully the miners took from one foot to three feet of *washdirt* from off the bottom (including several inches of soft slate), for a breadth of thirty feet along the course of the gully, and the stuff yielded $2\frac{1}{2}$ dwts. per load. In another part, at a depth of sixty feet, the gutter was eight feet in width, the *washdirt* from three to five feet in thickness, and the yield 5 dwts. per load. It was discovered subsequently that gold was distributed through the strata overlying the bed-rock in this gully for a depth of ten feet; and an eight-horse steam-puddling machine was erected for the purpose of puddling the stuff obtained from the south side. The machine was constructed to drive two puddling machines and a cradle. On the average, eighty loads per diem were put through, and the yield was about 12 grs. of gold per load. Gold was found in some parts all through the clay for a depth of twelve feet. The mining surveyor states that 840 loads of stuff gave an average of $\frac{3}{4}$ dwt. per load. The gully opens into a broad flat.

In West Gully, where the depth of sinking is twenty-eight feet, the ground is patchy; but *washdirt* is found generally over a breadth of eighteen feet, varying in depth from six inches to two feet, and the yield is about 15 dwts. per load. Near the Big Hill Reef, at the upper end of this gully, as much as 2 dwts. of gold were got from a tin-dishful of dirt, the depth of sinking being only four feet. The gold was exactly like that taken out of the reef.

Several other small gullies have given profitable employment to small parties; and when a larger population settles here much of the old ground will be re-worked and neighboring gullies will be prospected.

There are only eighty-five alluvial miners now employed in this locality.

The Blackwood goldfields are situate on the upper tributaries of the River Lerderdarg which have cut deeply into the schists, exposing in some places high cliffs.

"The formation of the Blackwood goldfield is peculiarly favorable for alluvial miners with limited capital, inasmuch as there is no deep sinking required, nor machinery for lifting water, as there is ample fall for drainage in every part; so that, in fact, the only outlay necessary is for sluicing-boxes and mining tools. Thus equipped, a party with a small capital, and a fair share of skill, patience, and perseverance, may realize a competency in a few years."*

* *Mining Surveyors' Reports*, p. 483, vol. III.

The most important gullies are named Nuggety, Yankee, Long, and Frenchman's.

In Nuggety Gully the depth of the alluvium varies from two to thirty-five feet.

In Yankee Gully, at Yankee Flat, the strata occur thus :—

	Feet	in.
Red surface soil - - - - -	2	0
Fine red sand - - - - -	3	0
Gravel - - - - -	2	0
Coarse ferruginous gravel - - - - -	1	6
Washdirt (consisting of coarse gravel and slate) - - - - -	0	6
Total depth to bed-rock - - - - -	9	0

Nearer the junction of the gully with the Lerderderg, at Hard Hill, the sinking is as follows :—

	Feet	in.
Red soil - - - - -	0	6
Sand, with fine gravel - - - - -	0	6
Fine gravel - - - - -	1	3
Yellow clay - - - - -	1	0
Coarse gravel - - - - -	0	8
Yellow and blue clay, and stones - - - - -	4	0
Fine ferruginous sand and gravel - - - - -	0	8
Washdirt, composed of coarse stones, clay, and rotten sandstone - - - - -	1	0
Total depth - - - - -	9	7

The strata lying in the bed of the Lerderderg, for a great distance, are auriferous, and yield sufficient in most parts to repay the skilful sluicer.

There are large areas lying to the east and west which have never been properly prospected.

The Steiglitz goldfield—mostly a quartziferous area—is situate on the upper sources of Sutherland's Creek, a tributary of the River Moorabool. It lies in a mass of outcropping palæozoic rocks, and is almost wholly surrounded by basaltic lavas.

The first great rush to Steiglitz took place, it is said, in November, 1855. Some parts of the alluvia were very rich. The shallowest workings were from two to three feet, and the thickest from twenty-eight to thirty feet in depth; and the operations of the alluvial miner were confined to the bed of Sutherland's Creek, Newchum Gully, Slaughteryard Gully, Macpherson's Gully, and Alluvial Gully.

At Moorabool, Tea-tree Creek, Dolly's Creek, Mount Doran, and Stony Rises—all in the Steiglitz Division—the miners have got gold in considerable quantities from the alluviums lying on the slopes of the hills. Formerly the miner kept close to the creeks, and altogether neglected the back gullies; but at Steiglitz, as well as in other localities, the outlying gullies are found to be highly auriferous. One miner, assisted by a little boy, got £100 worth of gold in one month; and nuggets weighing 10 ozs. are sometimes met with.*

* *Mining Surveyors' Reports*, vol. III., pp. 431 and 481.

There are 580 alluvial miners in this division, including those working in the leads near Moorabool.

Gold has been found, as already stated, in every part of the Ballaarat District where the palæozoic rocks appear at the surface; but, as an immense area is covered by basaltic lavas, we must look rather to the deep *leads* than to the shallow alluviums for our future supply of gold.

Auriferous drift has been found, it is said, as far south as the Gellibrand River, and gold, I am informed by a good authority, has been washed out of the sands near Duck Ponds.

The Mining District of Beechworth is bounded on the west and south-west by the River Goulburn and the Jerusalem River to the source of the last-named stream in the Main Spur; on the south-east by the Main Spur and the Main Dividing Range to the most eastern sources of the Kiewa Creek; thence by a subordinate range to Mount Nelson; thence to Mount Wills; thence to Mount Cooper; thence to Mount Gibbo; and thence by the Gibbo Range and a line south-easterly to Forest Hill; and on the east and north by the River Murray.

The chief mining localities are Beechworth, Yackandandah, Chiltern, Wahgunyah, the Upper Ovens, Morse's Creek, Omeo, Wood's Point, Maindample, Alexandra, and Ghin-Ghin; but large areas where auriferous quartz veins are known to occur have not yet been properly prospected.

This district, containing as it does rich veins, shallow alluviums, and deep *leads*, and yielding as well oxyd of tin (stream tin), molybdenite, and diamonds and other precious stones, is full of interest, and undoubtedly, when there is better and more rapid communication with the capital, will be a source of immense wealth to the country.

The Beechworth and Yackandandah goldfields are situate in a network of ranges which lie some twenty miles south of the River Murray. Here many of the tributaries of the River Ovens and the Kiewa Creek and some small streams flowing towards the Murray have their sources. Masses of granite protrude from the surface, and it is supposed that, owing to the manner in which the rocks have been denuded, the *débris* and *detritus* of the sedimentary strata have been left in many places in the valleys and hollows of the granitic masses.*

The miners have conveyed water in numerous races from the heads of the streams to their claims in the lower parts of the district, and an immense quantity of gold has been got out of the alluviums. Perhaps no part of the colony—not even Ballaarat—shows more remarkably the energy and activity of the mining population than this area.

In another place, under the head of "Sluicing and Hydraulic Mining," some of the peculiarities of this goldfield will be described.

Tin ore is found in many parts; and at Snake's Head Lead or Serpentine Creek, about a pound weight of black sand has been obtained from a dishful of dirt, and this sand gave 2 ozs. of gold to the ton.

The River Ovens is nearly everywhere auriferous, and a great many miners are employed in that part of it above Myrtleford. The lofty Buffalo Mountains on the west, the great range on the south, and ranges of considerable height on the east,

* See *Second Report of the Board of Science*, 1859.

quite enclose this area; and it is not easily approachable but by the narrow valley of the Ovens.

The eastern and western ranges are composed of granite, and they almost encompass the sedimentary rocks through which the River Ovens, the River Buckland, Morse's Creek, and Growler's Creek have their course.

Mining operations in the alluviums in this part differ somewhat from those in other parts of the colony. The valleys are generally narrow, and the ranges on each side are very steep and high; and the methods of conducting water and washing and sluicing are somewhat modified by the physical character of the surface.

Mr. R. H. Stone, in describing the general formation of the auriferous ground, writes as follows:—"The bed-rock is very uneven, consisting principally of soft yellow sandstone with veins of slate intermixed, and occasional bands of hard blue stone (metamorphosed slate), running nearly parallel to the river. The auriferous drift consists of heavy water-worn gravel and sandstone boulders, slightly intermixed with quartz, and having here and there layers of ironstone cement. In some places there are also in this formation enormous boulders of the bluestone rock, some weighing many tons. This drift is from three to fifty feet in depth, and is covered by red loam to a depth of from one to fifteen feet, and in the swampy ground by lighter-colored loam and beds of clay. Some portions of the drift are very hard and difficult to work, and others so loose as scarcely to require the use of a pick. The gold is sometimes found from the surface downwards, even in the deepest ground, but more frequently from the bed-rock to from one to five feet in the gravel; sometimes in the various layers of gravel where there is a change in the hardness of the stone composing it, with little through the bulk of the drift; and sometimes chiefly on the bed-rock itself, and to a considerable depth in the slaty veins in the softer portions.

"There are many channels through the flats considerably deeper than the existing river-bed, and the ground has generally been richest on the sloping reefs of these channels and in the more shallow ground, with but little gold in the pockets of the rock and deep gutters."

In the upper part of Morse's Creek the sinking is through "four feet of black loam and clay and six feet of heavy water-worn sandstone drift, and underlying these is the washing stuff of finer gravel slightly intermixed with yellow clay. The bed-rock is of soft sandstone. The gold is coarser than that usually found, and the yield was about half an ounce per load. Near Gander's Reef, a short lead on Growler's Creek was as deep as fifty feet, and mostly through heavy drift and sandstone boulders."

These descriptions apply only to the strata overlying the false bottom. When that is broken through deep shafts have to be sunk to the bed-rock, where are found true deep *leads*.

Very rich river claims have been worked in this division. One, taken up by six men, yielded from 60 to 150 ozs. of gold per week.

At the sources of the Ovens, near Harrietville, the river claims were energetically worked; and subsequently the miners found gold in the ranges at heights varying from 40 to 100 feet above the level of the streams.

Shut in by mountains, and for a long period forming almost a colony by itself, the escort returns have a value here that in other places they do not possess, because they represent probably with some approximation to truth the quantities of gold

actually raised. Mr. L'Espinasse Martin has compiled a statement of the gold sent away, from which the following figures are extracted :—

		Gold by Escort.					Gold by Escort.				Number of
		ozs.	dwt.				ozs.	dwt.			Miners.
1861	-	52,656	10	-	6,580	1865	-	43,706	10	-	2,614
1862	-	49,853	0	-	8,370	1866	-	41,969	10	-	2,150
1863	-	50,600	10	-	3,210	1867	-	36,224	15	-	1,897
1864	-	50,244	10	-	2,484						

The above statement includes the gold obtained from the reefs as well as that got out of the alluviums.

On the 30th September, 1868, the number of miners was as follows:—

	Europeans.	Chinese.
Alluvial miners	- - - - 178	- - - - 1,417
Quartz miners	- - - - 422	- - - - 13
Total	- - - - 600	- - - - 1,430

The Chinese in the Buckland Division, relatively in such large numbers to the Europeans, seem to be bolder, hardier, and more enterprising than in other places. They are very industrious, and on the whole orderly, but guilty often of thefts. They steal gold from sluice boxes and machines very frequently. They are good miners in shallow ground. A Chinaman will stand for hours up to the middle in water scooping gravel from the beds of the streams, while his partners wash the stuff in cradles or boxes on the bank.

The shallow alluviums at Indigo, at Yackandandah where extensive sluicing operations have been conducted for many years, and those found in the tributaries of the Mitta-Mitta, partake more or less of the character of those worked in the Beechworth and Buckland Divisions.

The following description of the alluvial workings at Wood's Point has been compiled by Mr. Ainsworth:—

"The area of country known as the Wood's Point District lies about N. 60° E. of Melbourne, and is distant ninety miles as the crow flies. It covers the heads of the Goulburn and a number of tributaries flowing from south to north that swell its waters before it reaches the great bend. It lies entirely on the northern slopes of the Great Dividing Range which separates the Gippsland waters from those of the Murray District.

"It is of schistose formation, the rocks belonging to the upper silurian series, and is remarkable for being traversed by dykes that have penetrated to the surface and are generally rich in metalliferous lodes.

"The valleys are very narrow. The beds of rivers and creeks are rock-bound and rarely exceed twenty yards in width. There is no deep sinking, and the alluvial miner is restricted to working the water-beds and such small spurs as may have served as shoots to the overtopping hills in guiding their treasures to the streams. The wash through which the alluvial miner works down to the beds of the creeks consists invariably of layers of water-worn stones, varying in size from that of pebbles to that of boulders, and is from two to twelve feet deep.

"The gold lies sometimes, but rarely, in a thin layer of sand or pipeclay, on the surface of the bed-rock; more generally in the crevices of the rock itself, often more or less rotten, which is broken up to a depth of twelve to twenty inches; and occasionally is found in what are termed pot-holes, from the fact that they are of the

form and size of a camp pot, say fifteen to eighteen inches in diameter and six to ten inches deep. In the latter instance the bed-rock is either a very hard blue schist or soft rotten granite. In the first instance mentioned the course of the stream is generally across the strike of the rocks, and the gold is found below a hard bar, as shown in Fig. 3; or on one side of the creek, as shown in Fig. 4. In the second and third instances (Figs. 5 and 6) the stream generally runs with the strike of the rocks, or at a slight angle; but the dip is nearly perpendicular in those instances where I have known pot-holes to occur. The mode of working these creek claims is of the simplest description. A head-race furnishes water for the sluice boxes, and turns, where required, a four-foot water-wheel working a Californian pump, which drains the paddock (a hole twelve feet square or thereabouts), and a tail-race carries off the water. These are the appliances in use.

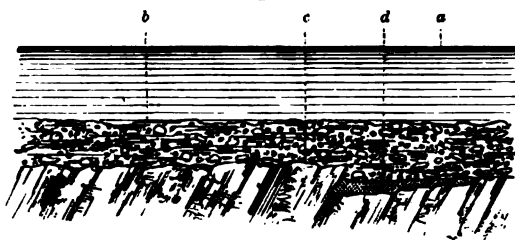
"The depth of wash put through the boxes varies with the experience of the miners and their working facilities. Sometimes the whole drift and twenty inches of the bed-rock are put through; but the gold is looked for chiefly in the washings off the bed-rock.

"The alluvial workings in the Wood's Point District are now confined almost exclusively to ground already worked, yet the produce cannot be much less than 1,200 to 1,500 ozs. per month.

"The alluvial gold in our bank workings or creek beds, as already stated, is found chiefly in the rock, which is slate, striking N.W. and S.E., and dipping nearly 90° . Some of these slates are soft and rotten to a depth of three feet or more; others are indurated and crystalline from the surface downwards. These differences

occur within fifty yards or less, and it is in the soft rock only that the precious metal

FIG. 3.



LONGITUDINAL SECTION.

a River. b Wash of large rounded flat slate pebbles, with quartz and a little gold. c Bed-rock slate. d Gold in sand.

FIG. 4.



CROSS SECTION.

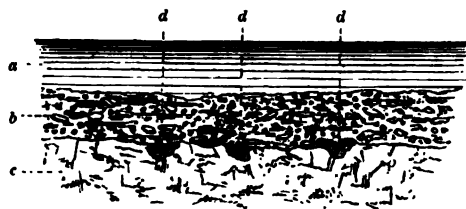
a Slate. b Gold in pipe-clay. c Wash.

FIG. 5.



CROSS SECTION.

FIG. 6.



LONGITUDINAL SECTION.

a Water. b Wash. c Rotten granite. d Pot-holes

is found. The gold is scaly or flattened. Nuggets are obtained in soft clay lying on the face of the bed-rock, at no great distance from it—say three or four feet at most. Whether found *in situ* or drifted they are, I believe, of later date than the reef gold. (The term as used here applies to alluvial gold found in the bed-rock.) In the Goulburn the bed-rock is commonly covered by a soft layer of heavy slate and granite boulders, in pipeclay, some two to six feet deep; and above this is frequently found a bed of clay and pebbles, from a few inches to two feet thick; and then a drift, composed of large flat stones, much water-worn, cemented with clay and ironstone grit, sometimes six to eight feet thick. The stones are flat—weighing as much as two hundredweight—and elongated, their longer axes lying with the current and their pointed ends up the stream. The last two drifts mentioned are sometimes absent, and in their stead we have a heavy bed of red clay with small quartz and slate breccia.

“The ‘color’ is got in all these drifts, but the best results are obtained from the bed-rock; from which I infer that the chief and earliest deposits of alluvial gold in these ranges are contemporary with the first great denudation of the granitic dykes, which are much more numerous than at present appears. At the heads of our water-courses the granite is never entirely absent, and the miner looks for a greasy wash near the bottom as a most favorable symptom.

“Small deposits of wash are found high up the spurs. I have found it 1,200 feet high, on the Never-mind spur. The gold lies in these cases in a soft clay, and is shotty and without quartz. Nearer the bed of the river, however, where some of the bank claims have proved very rich, the gold is again found chiefly in the slate; and the drift above the bed-rock is composed of slate boulders and clay, the granite boulders being less frequent and not so large as in the bed of the river.

“The alluviums are far from being exhausted in this district. Some of the creek claims have been working for five years, and have still a good deal of work before them; and the banks have not been even extensively prospected, though highly satisfactory results have been obtained in a number of instances. A few weeks ago no less than five claims, within three miles of Wood’s Point—two bank and three creek claims—were paying as high as £20 per man per week; and these claims, without exception, have been at work more than three years. The yields, however, are very fluctuating as a rule. I question if on any goldfield in Victoria, opened for the same number of years, payable gold can be got to the same extent, and with the same facility, as here in shallow sinking, though the necessities of life are so much higher and wages from £3 to £3 10s. The drawback to this goldfield is the utter absence of means of rational enjoyment, and the discomforts of life in a district where locomotion is attended with so much risk and fatigue. However good his earnings, however promising his future, the miner can only spend his time between his solitary hut with its discomforts or the publichouse and its poisons. Under such circumstances the noblest and best of men must deteriorate; and strong, indeed, must be the inducements that could bind him to a country where his very success in laborious pursuits is barren of happy results.”

That part of the Beechworth Mining District lying to the north of the River Goulburn, from the junction of the Jerusalem River westwards to Seymour, has of late attracted a good deal of attention.

In the north-eastern area, north of the Howqua, the rocks, according to Mr. Selwyn’s researches, are upper palæozoic; but in the lower parts of the Delatite River and Ford’s Creek the streams cut through upper silurians, and here we find the

same fossiliferous beds which are met with on the River Yarra, near the Botanical Gardens, and very nearly the same kind of quartz reefs which are worked at Anderson's Creek.*

"Much of the country in the immediate vicinity of Alexandra is undulating, with comparatively low grassy ranges and broad gullies, and flats timbered with red gum, and containing good loamy soil adapted to cultivation. * * * * * The appearance of the whole country around differs very materially from the older goldfields, except at the heads of the creeks. The hills have a smooth well-grassed surface, and reddish clay soils predominate throughout. This may be accounted for by the difference in the geological formation, which appears to be of the upper silurian period, and consists of very argillaceous shales, many of them tough, and exceedingly fine-grained micaceous sandstones."

"The first discovery of payable gold at Alexandra was made by Messrs. Alexander McGregor and Alexander Don, in the month of June, 1866. * * * * * The next discovery of gold that attracted the greatest attention, and was the principal cause of the recent rush, was made by Mr. Alfred Hunt in the alluvial ground near the head of the U.T. Creek, about eight miles north-east from Alexandra. * * * * * The workings are in the bed and shallow banks of the watercourse. The washdirt is about six inches deep, on a shale bottom, and consists of a reddish or blue clay with a little sandstone shingle and broken quartz with angular edges. But the creek at this place is a very narrow gutter, closely bordered on either side by steep hills, and, from the limited extent of the alluvial deposits, the claims must necessarily be soon worked out. About one hundred and fifty men were working in the creek at points below these payable claims, and in some instances holes seven to nine feet have been sunk in the gullies, which widen out considerably some distance down. The results appeared to be most unsatisfactory: some parties had obtained no gold, and others very small quantities. By one of these, consisting of four men, who were supplied with proper appliances for sluicing, I was informed that they had been working for about five weeks, and the earnings of the whole party had only averaged one pennyweight per diem."†

At Ghin-Ghin, on the River Goulburn, some five or six miles below Yea, a goldfield was discovered on the 9th August, 1867, and it was officially reported on the 12th August, 1867. The shallow alluviums are said to be very rich in some places, and as a great number of miners were attracted to this locality, we may hope to hear of more important discoveries. There is a mass of granite lying to the west and north, and we may expect to see numerous auriferous reefs and areas of shallow ground opened up on both sides of it.

The gold workings at the heads of the River Jamieson and the River Howqua, and those at Tallangalook Creek and Dry Creek, have not yet been properly opened, though a great deal of work has been done and a considerable quantity of gold got.

* Near the eastern outcrop of the upper silurian beds there are layers, full of fossils, which are traceable for a considerable distance in a north-easterly direction. We find them near the Botanical Gardens at Melbourne, at the Moonee Ponds, at Anderson's Creek, at Murrindindi and near Alexandra. They contain, in some places, a good deal of carbonate of lime. *Trilobites*, *tentaculites*, the *orthoceras bullatum*, *spirigera reticulata*, *hemithyris diodonta*, and a *pentamerus*, so characteristic of these rocks at home and in America, are found abundantly in the localities above named.

† Report of the Chief Mining Surveyor, 14th August, 1867.

At Cameron's Creek a party of miners found a nugget weighing 8 ozs., which is significant of the character of the reefs in this locality.*

Mr. Arrowsmith, mining surveyor, has taken some pains to compile information from local records respecting the discovery of, and the operations of the miners in the gullies trending towards the leads at Rutherglen, Wahgunyah, and Chiltern; and the following statements may, I believe, be relied on:—

"The Rutherglen goldfield, known as the Wahgunyah diggings, was discovered in September, 1860. On the 20th of that month the prospecting claim on the *Wahgunyah* lead was registered, on the 6th October the *Lanarkshire* was proclaimed, on the 10th October the *Robbie Burns*, on the 22nd October the *Hibernian*, and on the 24th October the *Clydesdale*. Then followed in rapid succession the *Young Wahgunyah*, *Rose of Sharon*, *Newcastle*, and *Clare*. During the ensuing November and December the following leads were opened:—*Sailor's*, *Perseverance*, *Eureka*, *All England*, *Rose of Victoria*, *Garibaldi*, and *Great Northern*. During 1861 eight more were added to the list, namely:—The *Rose and Thistle* (since called *Conquering Hero*), *Staffordshire*, *White Star*, *Union*, *Glamorganshire*, *Mona*, *Homeward-bound*, and *Tam O'Shanter*.

"The *Hibernian*, *Clydesdale*, *Newcastle*, *All England*, *Garibaldi*, and *Mona* lie chiefly in deep wet ground, where horse-power and, in some places, steam-power are required in the working of them.

"The Main Indigo Lead was the scene of a great rush in 1858. Thousands of miners congregated on the upper part of it; and miles of streets, lined by rude huts and calico tents, stretched downwards towards the deeper ground. But the miners and storekeepers soon shifted the sites to the lower part, where within twelve months nearly the whole of the population was located. The shallow diggings were rich, but the more valuable drifts occurred in patches, and it was not until the lead was opened that the miners generally became sure of a reward for their labors. In 1859 some parties got from £8 to £9 per week per man, and very few claims paid less than £4 per week per man.

"The lead—known in its upper part as the New Ballarat Lead and lower down as the Chiltern Lead—was first prospected in December, 1858,† under the auspices of the Indigo Prospecting Association. After sinking five shafts in ground exceeding 100 feet in depth they came upon stuff sufficiently rich to remunerate them, and they took out from the bottom of their fifth shaft 2 ozs. 16 dwts. 1 gr. of gold. Water, however, became troublesome, and they were obliged to erect a horse-whim; but this too failed; and finally they purchased a steam-engine, which was erected at a cost of £750. They then sank a larger shaft, and found a stratum of washdirt about four feet in thickness, which gave 1½ oz. per load.

"The Suffolk Lead was very rich, and the sinking for a considerable distance from its source downwards was dry and not very deep. A great deal of gold was got out of it, but it is now abandoned.

"The number of miners employed in the Indigo Division in May, 1859, was 3,329, of whom 3,154 were employed in alluvial mining and prospecting, and 175 in quartz mining. At the present time there are 557 alluvial miners and 78 quartz miners.

"The Chinese still continue to re-work the upper parts of the leads, and if there was a plentiful supply of water much of the old ground would yield fair returns. The

* *Mining Surveyors' Reports*, September, 1867, p. 16.

† *Chiltern Standard*, August 24th, 1859.

better prospects which present themselves in the deeper ground, however, will prevent the Europeans from resorting to the shallow diggings for many years to come."

The Mining District of Sandhurst is bounded on the south by a line from Eddington to Lockwood; thence south to Mount Gaspard; thence east to the Mount Alexander Range; thence by that range, the Myrtle Creek, and part of the River Coliban, to the junction of the River Campaspe and the Coliban; thence south-easterly to the range forming the basin of Mollison's Creek; and thence by that range and the main spur to Snowy Hill; on the east by the Jerusalem River and the River Goulburn; on the north by the River Murray; and on the west by the River Loddon.

The most important mining localities are Sandhurst (on the Bendigo Creek), Huntly, Sebastian, Raywood, Kamarooka, Myer's Creek, Bullock Creek, McIvor, Duck Ponds, Redcastle, Rushworth, Whroo, Kilmore, Reedy Creek, King Parrot Creek, and Yea; but a great many gullies and streams in all parts of the district far removed from these localities have been wrought in times past; and an immense area occupied by auriferous rocks is yet untouched.

The goldfields of Sandhurst are situate on the upper part of the Bendigo Creek and its tributaries. This stream takes its rise in the northern slopes of a spur of the Mount Alexander Ranges, and lies immediately to the north of the great mass of granite which separates Castlemaine from Sandhurst. The culminating points of the spur follow closely the junction of the granite and silurian claystones; and, indeed, it is nearly correct to say that the dividing ridge is the boundary between the plutonic and the sedimentary rocks. It is usual to call the range a line of upheaval,* but it is nothing of the kind. It happens that the sedimentary rocks are everywhere hard and tough and slightly altered near the junction with the granite, and have better resisted denudation than other parts, and hence are higher.

* Errors of this kind appear in nearly every work which treats of the physical geography of Australia. There is scarcely one range in the colony which is not due to denudation, and those following lines of upheaval have been so modified by the action of water, through countless ages, as to make it difficult to determine where and how the elevating forces have operated. The prevailing notion that all the hills and ranges have been violently thrust out of the earth is not confined to those who have never studied the laws of nature. It seems to find acceptance generally. In another part of this paper it is shown how the mountains in Gippsland (capped with recent tertiaries) have been left as gigantic Tors—the rocks which once surrounded them having been removed by marine and atmospheric denudation. The researches of navigators and others have proved beyond doubt that the north-eastern part of the island-continent of Australia is gradually sinking, and it is certain that the southern part has within a recent period been elevated; and if we struck a line across Australia in a north-westerly direction, from that point on the east coast which is intersected by the 30th parallel of latitude, it would probably very nearly pass through the area which is at rest. By supposing a slow and regular elevation of the great mass of land south of the 30th parallel, and regarding the denudations which would necessarily follow, it is easy to account for all the variations of the level of the surface which we see. Only volcanic eruptions can have interfered with these diverse forces. Great hills and lofty ranges do not suddenly start out of the ground anywhere. The science of geology teaches that the elevating forces which have caused the greatest changes on the surface of the earth have operated very slowly over vast areas, and during immense periods of time, and only in exceptional cases are we permitted to guess at the limits within which these forces have been confined. Even in Australia, where the upraised estuary beds on the south, and the Great Barrier Reef on the north-east, afford glimpses of the extremities of the balance, we cannot yet speak with certainty as to the geological period within which the elevating forces ceased in the north-east, and the land began to sink. It is probable that there have been many oscillations. It would not be difficult to construct a model consisting of earths and clays of different degrees of hardness which, when exposed to a fine spray of water, would exhibit some of the phenomena which I have attempted to describe here, and in other parts of this paper.

The Bendigo Creek runs nearly due north for sixteen miles, and its basin is bounded on the east and on the west by low ranges of schistose rocks, running north and south, and throwing off numerous small spurs, some nearly at right angles to the principal lines, and some nearly parallel to them—thus forming subordinate basins, many of them very small, and only one or two of considerable extent.

Some of the tributaries of the Sheepwash Creek, which drain the slopes of the range on the east, and those of Myer's Creek and Bullock Creek on the west, are auriferous. The Bendigo basin, hollowed out of tilted rocks composed mostly of soft mudstones, sandstones, and slates, with *graptolites*, contains in all its gullies beds of sand, drift, and comminuted slate, with numerous fragments of the reefs which have been broken up and removed by the waters. The gullies on the east side of the upper part of the existing watercourse are notably auriferous; but those on the west side, for some distance northward, contain but little gold.

The Bendigo Creek itself—Kangaroo Gully with its tributary Tipperary Gully, Adelaide Gully, Golden Gully, Bendigo Flat and Spring Gully, and Spring Creek, are the most important localities on the east; and New Chum Gully, Ironbark Gully, Sparrowhawk, Derwent Gully and Long Gully, American and California Gullies, Job's Gully, Eaglehawk and White-horse Gully, are the principal sites on the west. All these lie within the watershed of the Bendigo Creek; but connected with the Sandhurst goldfield are Devonshire Gully, Pegleg Gully, Sailor's Gully, and Napoleon Fiddler's and Wellington gullies trending towards Myer's Creek.

Though now more remarkable for the large yields of gold from its quartz veins than for its alluvial deposits, Bendigo at one time attracted thousands to its shallow gullies, and many tons weight of gold have been got from them. Its gullies were exceedingly rich.

The area of this goldfield is nearly sixty square miles, and about one-fourth of it is occupied by alluviums. The rest is composed of silurian rocks, intersected by quartz veins, a description of which is given in another place.

The older drifts occur at Bendigo as elsewhere. The low rounded hills, composed of clays, cement, and rounded pebbles of white quartz, are well known to every miner who has worked on this goldfield. These hills have been undermined almost completely, and nearly all the washdirt has been taken out.

Mr. G. W. Hart, mining surveyor, has made notes of some of the features, which are deserving of record. From his reports the following sections are taken:—

Near the head of Kangaroo Gully:—

	Feet	In.
Original surface—Dark loam - - - - -	6 inches to	1 0
Sand, with very small fragments of slate and quartz very sharp and angular - - - - -	1 foot to	2 0
Compact sandy gravel, changing gradually to quartz gravel, particles increasing in size towards the base of the stratum - - - - -		5 0
Sand and gravel, principally sand, without quartz pebbles -		1 0
Auriferous drift—Gravel, sand with very fine quartz, and a small proportion of sandstone intermixed with large quartz boulders, varying from 6 inches to 12 inches in diameter - - - - -	1 foot to	5 0
Decomposed bed-rock, very compact white clay, 9 inches to		1 0
		15 0

At the junction of Tipperary and Kangaroo Gullies a section shows the following layers :—

	Feet	in.
Surface soil, say - - - - -	0	9
Sand mixed with fragments of quartz and sandstone (not waterworn) - - - - - 1 foot to	2	0
Hard dark clay - - - - -	0	3
Red and yellow indurated clay in alternate layers of about two inches in thickness - - - - -	1	0
Gravel intermixed with fine quartz - - - 6 inches to	1	0
Layers of red and yellow indurated clay, sand and soft sandstone in alternate layers, three to four inches in thickness	1	0
Fine gravel with fragments of angular quartz - - -	0	6
Auriferous drift—Coarse gravel with fine quartz, and a small quantity of sandstone (not waterworn), and large quartz boulders - - - - - 3 feet to	4	0
Decomposed bed-rock—Pipeclay - - - 6 inches to	1	0
	11	6

A section made at the junction of Golden Gully and Bendigo Flat is very similar to the above. The bed-rock is there laid bare to a considerable extent, and a well-defined quartz reef, about five feet in thickness, is seen cutting through the sandstone.

Where Spring Gully enters Bendigo Flat the layers are found thus:—

	Feet	in.
Surface soil, say - - - - -	1	0
Hard sandy soil slightly mixed with gravel and a small proportion of very fine angular quartz - - -	8	0
Auriferous drift—Loose gravel intermixed with fine quartz and sandstone in small proportion, and large quartz boulders - - - - - 8 inches to	1	0
Decomposed bed-rock—Pipeclay - - - 6 inches to	0	8
	10	8

At Bendigo Flat, west of the hamlet of White Hills, the sinking is as under:—

	Feet	in.
Surface soil, say - - - - -	1	0
Sand mixed with angular fragments of quartz and sandstone - - - - - 1 foot to	2	0
Hard dark clay of a reddish brown color - - - 4 feet to	5	0
Loose gravel intermixed with fine quartz - - - 8 inches to	1	0
Loose sandy gravel, more compact in the lower part, 5 feet to	6	0
Sand, gravel, and quartz - - - - -	2	0
Auriferous drift—Loose gravel with sand and small angular fragments of quartz and schist - - - 3 feet to	7	0
Decomposed bed-rock—Pipeclay - - - -6 inches to	1	0
	25	0

The ground gradually deepens as it is followed northward until it becomes a deep lead. In some parts it would appear that the older drift of the age of the White Hills

has been much denuded, only the lower layers being left, and that there have been superimposed thereon newer auriferous drifts. The miners not infrequently break through a false bottom (overlying which there is the usual rich washdirt) and after sinking through sand, gravel, and clay reach another layer of washdirt immediately overlying the true bed-rock.

Not without a careful survey, many accurate levels, and close attention to the sections, will it be possible to say how many auriferous layers of different ages are to be found on this goldfield. It is probable that the detritus brought down quite recently from the older hills may overlies the ordinary alluviums, forming a younger stratum also gold-bearing.

The large area of shallow alluviums was at first very hurriedly washed with the tub and cradle, and as there was then, as now, not much water, a considerable quantity of gold was left in the soil and in the tailings. It was again turned over by the puddler; and in 1860 there were 1,592 horse-puddling machines in use, each giving employment to three or four men and two horses. Now there are only 433, and not all these are always at work. The Chinese continue to wash the old gullies, and they strip them quite down to the bed-rock; but it is certain the alluviums will not be exhausted until they are sluiced, and this will be done as soon as a plentiful supply of water is available at a very low price. The flatness of the area will, however, be an impediment to the sluicer, but not an insuperable one.

The operations of the puddlers at Bendigo resulted in vast quantities of sludge being carried down the valley, and it accumulated in the level parts and spread to such an extent as to injure seriously the properties of many persons. The attention of the Government was directed to the matter, and a commission, with the Honorable J. F. Sullivan as chairman, was appointed in November, 1858, to enquire into the best method of removing sludge from the goldfields. At Bendigo it had filled the natural watercourses, and at last almost put a stop to the operations of the puddlers. And this was not the worst—when a flood came the storm waters swept all before them, and the premises of the storekeepers were inundated.

Ultimately the Government constructed a storm-water channel and a sludge channel.

Among other interesting facts in the valuable report of this commission it is stated that two tons seven hundredweight of silt were taken out of a sludge drain at that time in use, at various points along its course, and subjected to the process of crushing and amalgamation at the mills of Messrs. J. Young and Company, at Kangaroo Flat. Every precaution was taken to insure a truthful result, and three members of the commission, Messrs. Carpenter, Merrett, and O'Keefe, superintended the operations, and they declared that, in their opinion, the yield of gold obtained, namely, 4 dwts. 2 grs., or nearly 2 dwts. to the ton, might fairly be taken as the average proportion of gold left in the silt carried away from the puddling mills—a proportion which, they remark, is more than equal to the yield in many parts of the goldfields from the puddling of old ground.

This conveys a better idea of the character of the alluviums at Sandhurst, than could be given by a few isolated statements of the yields from the washdirt. Bendigo, indeed, is still a bed of gold, and with better appliances and plenty of water, its drifts and sands will continue to furnish no inconsiderable proportion of the gold which is raised in the colony. The stuff that even now is carried away from the mills is richer than much of the sand which in other countries is eagerly washed by the miner.

A description of the leads will be found in its proper place.

At Bullock Creek the depth of sinking is from twenty-seven to thirty-five feet. The adjacent ranges are low, and there is no basaltic rock in the vicinity, and it is therefore comparatively easy and inexpensive to follow the course of the gutters.

The strata occur thus :—

	Feet	in.
Surface soil - - - - -	2	0
White indurated clay - - - - -	20	0
Light brown sandy gravel - - - - -	1 to	5 0
Conglomerate, red and brown, and water-worn quartz	1 in. to	0 4
Washdirt, with rough reef gold mostly attached to fragments of quartz - - - - -	6 in. to	2 0
	29	4

The yield varies from 1 dwt. to 2 ozs. per load, and the gutters in some places are more than 100 feet in breadth.

In the Kilmore division there is a large area of alluvial ground, but only a small portion has yet been opened.

About 450 miners find employment at the sources of the Dabyminga Creek, the King Parrot Creek, the Muddy Creek, and the Kurucuruc Creek.

The Acheron, and nearly all the streams which flow northwards from the Main Spur of the Great Dividing Range, are auriferous. They cut through generally soft mudstones, sandstones, and slates of the upper silurian age, which are everywhere rich in fossils, and many thin quartz reefs are found in places where the bed-rock comes to the surface.

The descriptions of shallow alluviums in other places apply to these.

Mount Ida Creek and its tributaries, and large areas at Rushworth and Whroo, have been wrought for gold, and though nearly 700 miners are now employed in getting gold out of the alluviums on these fields, scarcely any information is available as to the character of the auriferous soils.

In the Waranga division the strike of the bed-rock is east and west, and some of the quartz reefs intersect these at right angles; but the greater number run nearly in the direction of the strike of the rocks.

A great many nuggets have been found at the head of the Wild Duck Creek, and in the McIvor Creek; and in other parts of the division the washdirt yields from $\frac{3}{4}$ dwt. to 1 dwt. per load.

Though we have no intelligible description of these goldfields, it is certain that they possess features which are worthy of attention; and looking at the extent of the area occupied by auriferous rocks, we may safely assume that they will in due time engage attention. All the small creeks running into the Goulburn, towards the east, and those flowing into the Corinella Creek, and the Campaspe, on the west, will be opened hereafter, and wrought for gold, and in following these, the miner will be led by the trend of the leads towards the River Murray.

Quite 1,200 square miles in the county of Rodney offer fair chances of success to the prospector; but the country will not probably be explored until by maps, plans, and descriptions, the character of it is made known.*

* Since this was written an important discovery has been made at Spring Creek, near Mount Moornbool, about twelve and a-half miles from Whroo. What appears to be a rich lead has been opened. The depth of sinking is from fifty to sixty feet, the washdirt from two to three feet in thickness, and the yield from 15 dwts. to 1 oz. 5 dwts. per load. In the lower part of the lead the yield is in some places 2 ozs. per load.

The dense Whipstick Scrub, lying to the north of Sandhurst, was for a long time a barrier against the progress of mining in the plains which stretch to the River Murray. Accidental fires burnt off part of the scrub, and by-and-by, slowly, the miners were able to get into it; but the want of water, the flatness of the ground, the absence of bed-rocks cropping out on the surface, which in other places serve as guides to the explorer, prevented them from following the trend of the alluviums which they from time to time discovered.*

At Neilborough and Raywood, about fifteen miles north of Sandhurst, and at Kamarooka, about twenty-five miles north-east of the same town, very rich diggings have been opened.

The gold found at Raywood is generally coarse, and many nuggets, from 2 ozs. to 110 ozs. have been taken out of quite shallow drifts. In some parts the auriferous drift is composed of hard cemented white sand, which requires blasting to remove it.

The sinking varies from one or two to fifty feet.

Here again, as in Rodney, there is an extensive field open to the prospector, and it is beyond doubt that the leads touched at Raywood will ultimately be followed onwards towards the Murray. It is not to be supposed, however, that they will necessarily form wide gutters trending in that direction. It is more reasonable to infer that the denuded surface of the silurian rocks will preserve the same general character under the tertiary drifts as in other parts where these do not hide it. A succession of low ranges, intersected by quartz reefs and beds of drift, may be looked for under the tertiaries.

To penetrate the superficial covering in any part, as far northward as the Terricks, will not probably necessitate any very expensive works.

The Mining District of Maryborough is bounded on the east by the River Loddon, and its tributary the Deep or Tullaroop Creek; on the south by part of the northern boundary of the Ballarat District, and the Main Spur, to the Amphitheatre; thence by the range forming the basin of the River Wimmera to Heifer Station Creek; thence by that creek, the River Wimmera (to the point where it bends to the north), and a line west to the western boundary of the colony; on the west by the 141st meridian; and on the north by the River Murray.

The principal goldfields are Maryborough, Amherst, Majorca, Talbot, Avoca, Lamplough, Amphitheatre, Mountain Hut, Peter's, St. Arnaud, Moonambel, Redbank, Bet-Bet, Dunolly, Mount Moliagul, Cochrane's, Jones's Creek, Tarnagulla, McIntyre's, Jericho, Kingower, Inglewood, Wedderburn, and Korong.

The south-eastern part of the area, about 3,000 square miles, is occupied by silurian rocks, which are but thinly covered in places by quite recent drifts; and the whole of the northern and western parts are covered by the Murray tertiaries. The district includes but a very small part of the tract occupied by volcanic rocks, and the plutonic rocks also are limited in extent.

The Maryborough goldfields comprise the Four-mile Creek and its tributaries, many gullies and creeks lying to the east and trending towards the Deep Creek, and the Timor Creek lying to the west; all of them pouring their waters into the River Loddon. Low hills, composed of unaltered claystones, sandstones, and mudstones of silurian age, prevail; but on the east—its boundaries following the bends of the Deep

* A very rich patch has lately been struck in or bordering on the Whipstick near Sydney Flat. The ground is shallow, the gold very coarse, and many nuggets occur.

Creek—there is a covering of basalt; and a long narrow strip of the same rock, enclosing the Bet-Bet Creek, lies to the west. The auriferous alluviums in the valley of the Four-mile Creek extend continuously for nine miles, the breadth varying from five to forty chains; and numerous tributaries add to the available auriferous area.

The Timor Creek is auriferous throughout its extent, and has been worked more or less for a length of nine miles.

On all the hills auriferous quartz veins are seen cropping out at the surface, and the gullies having their sources near these have been very rich.

This area has, from time to time, been the scene of many large "rushes." Thousands of men congregated on one lead and commenced operations—and then, hearing of some remarkable discoveries, such as that of the Scandinavian Lead, or of Balaclava—immediately abandoned their claims to take up new ground in the adjacent creeks. The hills being low, and not very thickly timbered, the sinking not very deep and only in some places wet, the gold generally distributed—and supplies of stores, &c., readily obtainable—it has happened that this area has been more completely prospected and better developed than almost any other. This is easily seen when the map of the district is examined; and yet it cannot be said that all the gullies have been worked, or indeed opened—and as regards the deep *leads* they are scarcely touched at all.

The Maryborough Main Lead, Chinaman's Flat, Blackman's Lead, Griffith's Gully, and many other localities within the watershed of the Four-mile Creek, have for a long period supported a large mining population; and Adelaide Lead, Inkerman, Alma Flat, and Balaclava, on the Timor Creek, are yet far from being exhausted.

At Balaclava the strata are as follows :—

	Feet.
Loam - - - - -	4
Red clay and gravel - - - - -	13
Reddish clay - - - - -	18
White clay and sand - - - - -	12
Red gravel and sand - - - - -	8
White clay and gravel - - - - -	7
	62

The washdirt, composed of white clay and gravel, and small pebbles of quartz, is about one foot in thickness; the gutter is ten feet in width; and the washdirt averaged 5 dwts. to the tub.

Mr. E. O'Farrell, formerly Chairman of the Mining Board of the Maryborough Mining District, has communicated some information relative to the gold workings in his district.

He says :—"On arriving at Simson's Ranges, in June, 1854, seeking for new fields, I and my three mates found a prospecting party at work at a place since known as the White Hills. At that time there were only thirty or forty men in addition to the prospectors, and these were engaged principally in stacking or surfacing. No water was available to wash the stuff at any place nearer than Bet-Bet and Deep Creek—distant three to five miles from the auriferous ground. The hill was not of great extent, and situate in a large flat almost surrounded by a blind creek. The sinking was very difficult, being through white cement. One party bottomed on the edge of the creek and carried a drive towards the hill—where they picked out nuggets varying in weight from one to ten ounces. All the ground was

soon marked off in claims, though the sinking was hard and difficult. It was only by the use of gads that we could get through the hard cement, the depth of which was from ten to thirteen feet. It occupied parties from fourteen to twenty-one days to sink through this stratum. The bottom was a splendid soft white pipeclay, and though the washdirt taken out at that time was only some six or nine inches, yet the nuggets which could be picked out paid the men well.

"The next scene of operations was a hill about one mile south of the first gold workings, and on the same flat; and about two miles and a half from the site of the town of Maryborough. In its character it was similar to the first. The depth of sinking was from sixteen to twenty-four feet and through hard cement mixed with large white boulders. The washdirt taken out was only some four or six inches—but in it were found a large number of splendid nuggets thickly scattered over the white pipeclay bottom. In consequence of the distance from water there was little or no dirt washed from either of the hills. One load of forty small buckets washed by us yielded 3 ozs. This was not considered at that time sufficiently remunerative, as we had to pay £2 for the carting of each load. Payable gold was discovered just at this time by another party, about three miles higher up, in shallow ground, about three feet deep; and to that we removed. Claims were marked out rapidly—a rush set in—and it was fed by parties returning disappointed from the shallow diggings at Avoca. Gold was found in almost every hole—and within a period of less than three months from the time when I first saw the prospectors' tent near the site of the town of Maryborough, there were at least thirty thousand miners on the ground.

"The rush after this time increased. The depth of sinking varied from four, six, eight, ten, fourteen, twenty, up to thirty-five feet, at which depth it began to bear the name of Blackman's Lead. Another branch of the same lead extending south towards Amherst—which was very rich, and in depth not exceeding seven or ten feet—was traced down the flat, where it narrowed from fifteen or sixteen claims of twenty-four feet each to a width of four or five claims towards the point of its junction with the Blackman's Lead.

"The value of those leads is well known, but I, myself, witnessed prospects from one shovelful of dirt taken out of the gutters of 18 and 20 ozs. The same stuff washed on an average for about two feet in thickness as much as 24 and 36 ozs. of gold to forty small buckets. This was out of the Main Lead gutter—not by any means as rich as the Blackman's Lead, which yielded nuggets of all shapes and sizes.

"The sinking on both the leads was easy, being yellow clay on the surface, with layers of red and white gravel intermixed with a heavy wash of boulders and gravel on the bottom—which was composed of slate and soft pipeclay (decomposed mud-stone). The washdirt at that time taken out varied from one foot to three feet in thickness—but since then the strata have paid puddlers and others, in many places, from the surface to a depth of twenty feet.

"It was thought that the ground at or below the junction of the two rich leads would be exceedingly valuable, but such was not the case. At the junction the ground was poor for nearly half a mile, and it was only where the lead took another bend and left the side of the range that the gold again became plentiful. This part was named Commissioner's Flat. Here the sinking became deeper, varying from fifty-five to sixty-five feet, the gold being scattered; the lead from fourteen to sixteen claims in width; the washdirt from two to five feet in thickness; and the average yield from four to ten ounces to the load of forty American buckets.

"About the year 1855 the miners left Maryborough to seek better fortune on the south side of the Dividing Range, at a place named Alma, where gold was obtained in an extensive flat at a depth of five feet. This place is about two and a half miles from Maryborough. Some of my acquaintances made as much as £500 and £800 out of claims measuring only twenty-four feet. The sinking increased from five to seventy-five feet, and finally the flat made a junction with the Balaclava and Portuguese Leads—two very valuable leads within five miles of Maryborough.

"These, like other leads in the district, were first opened on the surface, and were traced about two and a half miles; being in some places only three or four claims in width, and in others from twenty to thirty, widening towards the junction with the Alma Lead.

"The sinking on these leads, as well as the Adelaide Lead, Waterloo Flat, Inker-man, and Slaughter-yard Hill Lead was all of a similar character; consisting of yellow clay on the surface, with layers of gravel to the bottom, which was composed of slate. The washdirt averaged from six inches to three feet in thickness, and the yield was from 1 oz. to 4 ozs. to the load. While thousands were rushing about and sinking on the Alma, Balaclava, and other leads, hundreds betook themselves to prospecting the shallow gullies near Maryborough, most of which empty themselves into the Carisbrook or Deep Creek. The principal gullies are Madman's, Deadhorse, Flagstaff, Shellback, Oldman's, Mosquito, Blucher's, Smoky, Whitehorse, Arnold's, Ironstone, Golden Point, and Nuggety—all of which were extremely rich, but for the most part only one claim in width. The depth of sinking varied from mere surfacing to twenty feet. In some of these gullies nuggets were got which weighed upwards of 700 ozs. In all the sinking was easy, through clay and gravel, except in places where the ironstone cement was found.

"After the lapse of two years, during which period many rushes had occurred, Maryborough was almost deserted; but another new and valuable discovery was made at Chinaman's Flat, about one mile and a half from the spot where gold was first found at Maryborough. The locality was on the Bet-Bet or east side of the Dividing Range. Thousands again flocked to the spot. The large flat was found to extend towards the Bet-Bet for a distance of eight miles, and the country was discovered to be rich in quartz reefs as well as alluviums. The famous Leviathan Reef is now worked as successfully as when first opened. The gold in this lead, as in most others, was discovered on the surface, and gradually traced into deeper ground. The lead in some places was of great width, the sinking being principally through white clay or mullock, until within a few feet of the bottom, where it became a heavy wash of white gravel and boulders. The depth of washdirt at that time taken out was from two to five feet, and the average yield over 4 ozs. to the load. At a distance of five miles from its source the lead increased in depth to 130 feet, and much water was met with. This so far obstructed the operations of the miners as to prevent the exploration of the lead, though it is known that the washdirt is rich in gold. The same difficulty presented itself in following the course of the Alma, Balaclava, and other leads; and was not overcome until some of the Ballaarat miners settled in the district and introduced horse-whims. In many places even these were unequal to the work of keeping down the flow of water, and subsequently better machinery was introduced.

"I need only now speak of Majorca. Here a prospecting shaft was bottomed in the beginning of March, 1863, in the middle of a very extensive plain, known as McCallum's Creek Plain. The depth of the shaft was eighty-five feet, through stiff clay, gravel, and cement. The washdirt was white gravel, intermixed with heavy

boulders, on a soft pipeclay bottom; its thickness being from two to five feet. It averaged in some places 3 ozs. to the load.

"Finally a rush set in, and before three months had elapsed there were more than 15,000 miners on the ground. The sinking became deeper as the work went on, and was so wet that whims had to be erected; and at one time, in 1865, over 170 might have been seen at work, both night and day. Subsequently steam machinery was procured, and now no less than ten engines, varying from 15 to 50 horse-power are constantly employed in pumping, winding, and puddling. The lead, in its lower part, is 160 feet in depth, and is evidently extending towards the Carisbrook, Moolart, and Charlotte Plains, where so much is expected by all scientific men."*

The Daisy Flat Lead, at Amherst, is about seven miles in length, and in some places is nearly a mile in width, and there are many patches of shallow alluviums in its neighborhood, the gold having been derived from the numerous parallel veins of quartz lying to the south-west.

The Back Creek, which is a tributary of the Deep Creek, is remarkable for the numerous shallow alluviums at its sources; the aggregate length of all the gullies and flats being nearly twenty miles. Conspicuous amongst them are the Scandinavian Lead, Nuggety Gully, Long Gully, Liverpool Lead, and Kangaroo Flat. These trend towards the basaltic area, underneath which the auriferous deposits occur as deep leads.

Auriferous deposits opened on the east side of Mount Glasgow, and nearly at its base, present the following section:—

	Feet.
Gravel and loam - - - - -	30
Sand and gravel - - - - -	35
Red drift and gravel - - - - -	17
	82

The bottom is decomposed claystone and sandstone. A gutter, fifteen feet in depth and four feet in width, was discovered here some years ago; and the washdirt, two feet in depth, gave $2\frac{1}{2}$ ozs. to the load.

The Amphitheatre and Mountain Hut diggings are on the sources of the River Avoca, and lie immediately north of a basin, having the western spur of the Great Dividing Range for its southern rim. The basin is composed of granite, and the dividing ranges follow nearly the lines of the boundaries of the rock formations.

The Amphitheatre diggings are about four miles in length. In many parts the washdirt is two feet in thickness, and the yield has been as high as $\frac{1}{2}$ oz. to the load. Where there were large quartz boulders the gold was very fine.

The Eighty-feet Hill and Canadian Hill attracted at one time a numerous population. The washdirt is from five to six feet thick, and 1 oz. to the load has been got from it. The first three loads of washdirt from Canadian Hill gave 1 oz. 18 dwts.

At Mountain Hut the washdirt varied from three inches to twelve inches in thickness, and the yield was on the average $\frac{1}{2}$ oz. to the load. The depth of sinking is from four to twelve feet in the shallow parts, and in others as much as forty feet. In the deeper ground, where there is much shingle and water-worn quartz, the washdirt gave 1 oz. to the load.

* The rush at Majorca was seen by the Honorable J. F. Sullivan, Minister of Mines, shortly after the workings were opened, and it presented at that time a scene of busy industry; where there was more of order and decency and good behaviour than would be found probably in any mining locality in England, or on the Continent of Europe.

This area has not been properly prospected—and large tracts are yet untouched, which will hereafter undoubtedly be opened with advantage—and when there is a larger population some energetic efforts will be made, most probably, to discover the reefs from whence the gold has been derived, and the deeper *leads* into which the shallow gullies trend.

Lamplough is situate on an eastern tributary of the Avoca River, and the diggings extend along the creek for some three miles. The old Avoca Lead, more than four miles in length, lies to the north-west; Four-mile Flat and Homebush are about two miles to the north-east of the latter; and many other small patches of worked ground lie in the neighborhood.

At Lamplough the rich ground occurred in patches. In one case 108 ozs. were obtained from five loads of washdirt.

Barber's Gully, about two miles from Lamplough, on the Lexton Road, was opened in consequence of the discovery of rich washdirt on the surface near its source. At first from six to eighteen inches of the surface soil were washed, and this stratum gave about half an ounce of gold to the load. Four men were able to wash nine loads per diem, and sometimes they got as much as 12 ozs. per diem. Some patches gave as much as 2 and 3 ozs. per load. The trend was followed, and the depth of sinking increased gradually to thirty feet. Other gullies have been opened in the immediate neighborhood.*

The creeks at the sources of the Pyrenees Range have yielded a good deal of gold, and in some parts it was rough and nuggety.

It is not possible to give an accurate description of all the small gullies, creeks, and flats which have been opened in this area.

Patches of rich alluviums occur on small creeks in the neighborhood of Peter's section, about six miles south-east of St. Arnaud. The depth of sinking varies from six to sixteen feet, and the washdirt in many parts has yielded an average of 1 oz. to the load.

The St. Arnaud goldfield is not less remarkable for its steady yield of gold, where it has been properly worked, as for the silver which is found in the veins in its neighborhood.

The alluviums are scattered over an area which stretches some fifteen miles from east to west, and some five miles from north to south; and the principal diggings are about ten miles west of the River Avoca. It lies on the borders of the vast tract which is covered with the Murray tertiaries, and the lines of auriferous drift have, indeed, been followed into these—giving support to the theory that these extensive level plains will sooner or later be invaded by the miner.

Mr. Charles H. Raven, formerly the mining surveyor of this division, thus describes the country:—

“The general characteristic of my division is a succession of ranges and gullies, composed of schists and sandstone rocks. The general bearing of the ranges is N.N.W. and S.S.E., and that of the gullies east and west, falling into the main valleys on each side of the main ranges, and of necessity following the same direction. These ranges are nearly in every place very steep. The centres of the valleys on either side are worn away by the rapid passage of water, in some places to the bed-rock; these

* *Mining Surveyors' Reports*, p. 291, vol. II.

courses being from ten to twenty feet deep, all of which in places have been found to be more or less auriferous. * * * * * As much as thirty pounds weight of gold have been taken from one claim."*

This area is very dry. Rain falls seldom, and it is not generally retained in surface holes, as in some other parts of the colony. It seems to scour the watercourses when it falls plentifully.

The want of water has prevented the miner from operating here as energetically as he would do if he had the means of washing the rich washdirt.

The numerous cement hills in this tract are very rich. Washdirt taken from a depth of thirteen and twenty feet has yielded from $\frac{1}{2}$ to 1 oz. per load of fine gold, and it is certain that a great deal has been lost by the operation of washing. Only crushing and amalgamation will recover gold from this kind of stuff.

Moonambel, Redbank, and Lambing Flat; Sing-song Gully and Victoria Gully, near Stuart Mill; Cor-a-pooee Creek, Mogg's Rush, and a great number of other gullies and creeks, within an area of 400 square miles, have been found to be auriferous; and, with a good supply of water, they would support in comfort a very large population for many years.

At Hine's Rush many large quartz boulders are found, and much of the gold in the deep ground is quite black, while that in the shallow parts is clean and bright.

A low range of schistose hills extends northwards from the granitic mass at the Amphitheatre to the granitic ranges at the head of the Burnt Creek; and this range separates the waters of the River Avoca from those of the River Loddon. Burnt Creek, which flows into the Loddon, has its sources in the hilly district of Mount Moliagul, and the stream is auriferous throughout its course. Its basin is bounded on the north-east and south-west by silurian rocks, which enclose numerous rich quartz reefs.

Near the sources the diggings are known as Mount Moliagul; further south, towards the town of Dunolly, as the Inkerman; and below Dunolly, as the Burnt Creek.

The first great rush occurred in June, 1856.†

The old files of the *Argus* contain some facts relative to the results of the mining operations in July, August, and September, 1856. The reporter wrote that the main street, for about a mile in length and half a mile in width, was then being worked; and that the sinking was about forty-five feet in depth, with a bottom of very white pipe-clay. He saw a digger wash an ounce of gold from three cradles full of stuff, and observed his dissatisfaction. One man, he said, got £5,000 worth of gold in nine days, and another picked up a nugget weighing 22 lbs. Subsequently other nuggets, weighing respectively 108 ozs. and 99 ozs., were got; and a population estimated at 50,000 were as busy as a hive of bees.

But this state of things did not continue for a great length of time. The number of miners was soon reduced. Daisy Hill, Alma, Jones's Creek, Bet-bet, Kingower, and other places were so rich that the miners dispersed rapidly, and opened out new fields towards the north and the south.

The average depths of sinking in the several mining localities in this area are, at and near Moliagul from mere surfacing to twelve feet; at Inkerman from twelve to twenty feet; and at Burnt Creek from twenty feet to fifty feet.

The main run of auriferous ground receives numerous tributaries, as Bulldog and Wattle Leads, and Wilson's and Wilddog Leads at Burnt Creek.

* *Mining Surveyors' Reports*, pp. 221 and 222, vol. II.

† Mr. F. Knox Orme, Warden, &c.

The following sections illustrate the character of the drifts on this goldfield, and the neighboring diggings at Sandy Creek:—

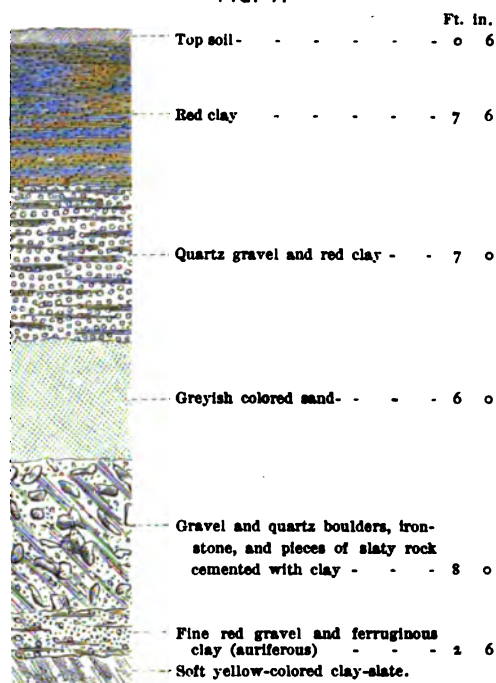
Near the town of Dunolly the drifts are deeper, and there are some low rounded hills whose age and character have not yet been ascertained.

A great many large nuggets have been found at and near Dunolly, and on the adjacent goldfields.

It is necessary to repeat here what has been already stated respecting other similar goldfields. Notwithstanding that there is a large drainage area occupied throughout its whole extent by auriferous rocks, there has been but little done towards the development of it, except in the immediate neighborhood of the main lead. The back ranges have not been properly prospected, and many probably rich gullies and reefs remain untouched.

The shallow drifts at Jones's Creek, Sandy Creek (Tarnagulla), Inglewood, Kingower, Korong, and those still further northward in the scrubby country occupied by the

FIG. 7.



MAIN LEAD, DUNOLLY.

FIG. 8.

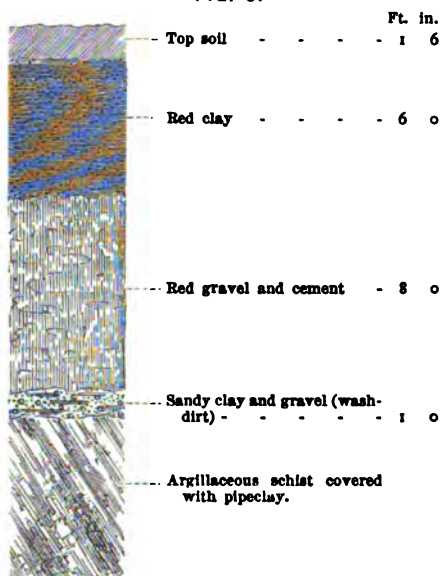
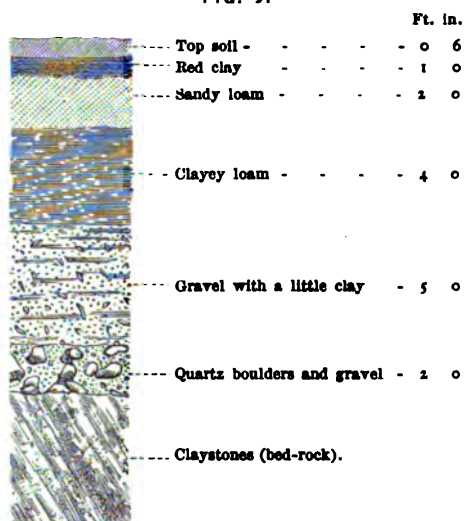


FIG. 9.



MAIN LEAD, SANDY CREEK DIGGINGS.

Murray tertiaries, are very rich in some places, and have in past times yielded much gold. And where we find rich patches of recent drift we know that veins must be near at hand. They are present, without doubt, in nearly every part of the area; and, if the country were not so dry, and so far distant from the central goldfields, it would receive much more attention than has yet been bestowed on it.

About 250 square miles of country between Korong and the River Avoca, and about 170 square miles between Korong and the River Loddon, are mere blanks on the mining map of the district; and yet they present everywhere the same features as are found on some of the rich goldfields towards the north.

The Mining District of Castlemaine is bounded on the west by the Tullaroop or Deep Creek; on the north by a line from Eddington to Lockwood; thence south to Mount Gaspard; thence to the Mount Alexander Range; thence by that range, the Myrtle Creek, and a part of the River Coliban to the River Campaspe; thence south-eastwards by a line and the range forming the basin of Mollison's Creek to the Main Spur; and thence by the Main Spur to the sources of the River Yarra; on the east by the Great Dividing Range and the eastern boundaries of the County of Mornington to the sea; on the south by the sea coast westwards and northwards to the Mordialloc Creek; thence by that creek and the Gippsland Road to the River Yarra; thence by that river and the Darebin Creek to a point east of Pentridge; thence by a line west to the Djerriwarrah Creek; on the west by that creek to the Main Spur; and thence by the Main Spur and the north-eastern boundaries of the Ballarat District (as formerly described) to the Tullaroop Creek.

The district includes the greater part of the counties of Talbot, Bourke, Evelyn, and Mornington.

The principal goldfields are Castlemaine, Fryers' Creek, Taradale, Yandoit, Hepburn, Daylesford, Blue Mountain, Malmsbury, Anderson's Creek, and the Upper Yarra; but there are numerous other localities inferior in importance, of which a list is given in another part of this paper.

The goldfields of Castlemaine are situate mostly on Campbell's Creek and its eastern tributaries. As has been already stated, it lies within, and on the west, north, and east is encompassed by, a mass of granite of a horse-shoe shape—the eastern bend terminating near Taradale on the River Coliban, and the western south of Baringhup on the River Loddon. Barker's Creek, which has its sources in the granitic area, runs in a zigzag course nearly due south to the town of Castlemaine, where it is joined by Forest Creek, which drains the inner eastern space of the horse-shoe. From the junction of the two streams the course is southerly to the Loddon, and this part is called Campbell's Creek.

An orographic map shows a range of hills running nearly due north from Wuidkruirk in the Great Spur to Mount Alexander, and thence still further north to Sandhurst. This range divides the waters of the Coliban and Campaspe from the waters of the Loddon. There are other ranges running nearly parallel to it, and all these throw off numerous spurs nearly at right angles, and these again have subordinate lower ranges nearly at right angles, and thus are formed larger and smaller drainage areas of the form of rude parallelograms.

This system of drainage, it may be presumed, is due mainly to the position and strike of the rocks.

The greater part of the goldfield is occupied by not very high but in many places steep ranges composed of sandstones, mudstones, and slates of probably silurian

age. The rocks generally are not much altered until the boundary of the granite is approached, and here hard fissile slates are found.

The strata are everywhere intersected by rich quartz reefs.

All the small gullies and creeks are filled with recent alluviums, varying in depth from a few inches to fifty feet and more; and there are low rounded hills of still older drift, which, it is presumed, are the analogues of the deep *leads* which are found to the south.

At Cemetery Flat, Campbell's Creek, the section of the alluvium is as follows:—

	Feet.
Black soil - - - - -	4
Clay - - - - -	5½
Shingle and water-worn quartz - - - - -	4½
Coarse auriferous drift - - - - - 1 to	1½
	15½

The yield at this place was from ½ dwt. to 8 dwts. to the tub, and the greatest quantity of gold was got on the harder slate rocks,* the soft pipeclay and sandstone bottoms giving the least.

Much of the rich ground at Castlemaine is from two to thirty feet in depth; and the strata are loam, sandy drift, clay, and angular and water-worn quartz. The auriferous drift is rather hard, and in places so rich as to glisten with gold.

At the head of Golden Point, near Expedition Pass, the miners found a good deal of gold. It was supposed that it had been left there by the workmen in the early days of the Forest Creek Goldfield, this locality being the first camping ground, and the place where they washed the drift. Since that time the waters have formed a course through the detritus overlying the granite, in the interstices of which, under the banks of decomposed granite, which are from six to twelve feet in depth, the gold was obtained. It was heavy and much water-worn.

Hitherto the granitic areas have been neglected, but with the experience gained at Beechworth and Maldon the miners might with fair prospects test some of the gullies and creeks within the boundaries of the granite near Castlemaine.

Mr. Thomas Laurence Brown has from time to time collected information respecting the yields of gold from the alluviums of this district, and the following statements are taken from his reports:—

In Dirty Dick's Gully the miners worked all the alluviums from six inches to six feet in depth, and they got from 10 to 16 ozs. to the tub of four small buckets; and there were "pockets" containing 100 ozs. and more—all evidently derived from the neighboring quartz reefs.

In 1853, Walker and party washed 6 ozs. to the tub, in Donkey Gully, but this did not satisfy them, and they left the place. In the middle of the gully they got from 12 to 20 ozs. to the tub, and on the sides from 6 to 4 ozs. to the tub, which was considered at that time not worth working. It is estimated that this short gully (less than three-fifths of a mile in length), has yielded at least one ton weight of gold.

The miners followed this gully to its junction with Forest Creek, where the depth of sinking increased to twelve and fifteen feet, and exceedingly rich ground was wrought in those places where the tributary streams had their sources near auriferous reefs.

* The same peculiarity was observed at Reedy Creek.

From the Red Hill there were four distinct lines of alluviums; the depth to the bed-rock on the sides being from one to six feet, increasing to fifteen feet with the trend. Here Chippendale and party took gold to the value of £30,000 from their claim. L. Murphy found 600 ozs. of gold in one pocket. Twelve ounces to the tub was the average.

From one pocket found near a reef crossing the line of auriferous drift, 1,800 ozs. were taken.

In Golden Gully, 18 to 20 ozs. to the tub were common. In Sheepshead Gully, Babcock took 456 ozs. from one hole, and then abandoned it.

On Dinah Flat, Mr. Brown himself saw 252 ozs. taken from one bucket full of dirt.

In Sailor's Gully and Sailor's Flat, pounds weight of gold per tub were not uncommon. T. Walker and partners (three), obtained 4,068 ozs. from a claim measuring eighteen feet by twelve feet, and some of their neighbours did better.

From the Hundredweight Hill (so called because of the great yields of gold), Edwards and party washed often as much as 360 ozs. from one tub of surface soil.

In shallow workings, eight feet deep, on the Forty-foot Hill, a claim eight feet by eight feet usually yielded 3,600 ozs. of gold.

Mr. Brown has been careful to give only such statements as can be verified by himself or others who actually obtained the gold or saw it washed.

There is yet much work to be done at Castlemaine, and nearly all the gullies will be turned over again as soon as a sufficient supply of water is available at a small cost.* That the work will be profitable there is no doubt. Even with such a rude appliance as the puddling machine, four men for several weeks got gold at the rate of £100 per week from Wattle Gully,† and there are many other gullies and flats quite as rich.

Fryers' Creek has its sources in the range which divides the waters of the Coliban and the Loddon. It takes its rise near Elphinstone, and joins the River Loddon near Vaughan. It drains an area composed almost exclusively of rocks of the silurian age, the surface of which is sculptured nearly in the same forms as are observed at Castlemaine, with this difference: there is not quite the same uniformity, and the peaks are sharper, and the upper valleys have steeper slopes.

The creek itself and nearly all its feeders are filled with auriferous alluviums; and these have been worked to such an extent as to change the character of the surface. Some of the gullies are completely undermined, and the surface is supported only by props.

Patches of the older drifts occur in many places, but their continuity has been destroyed by denudation.

* One effect of the introduction of great quantities of water for sluicing purposes will be the laying bare of the under surface of the gullies and flats, which, it is well known, are intersected by reefs. Lieut.-Colonel Bull, the Warden at Castlemaine, thus writes in a report dated 1st June, 1868:—"At the time of the water agitation, it was asserted that eventually long lines of reefs would be found below the alluvial deposits. Time has given proof of the truth of the assertion, and it is not too much to say that the more permanent benefits arising from the incoming of the Coliban water will be the number of reefs it will be the indirect means of disclosing. With regard to these reefs, there is one at Adelaide Hill, another at Butcher's Gully, and a third north of Castlemaine, a locality well known to abound in reefs, and I have now to report the discovery of a reef on Clinker's Hill, said to bear every indication of turning out one of the richest in the district, and apparently a continuation of the Ajax. The entire line has been taken up."

† *Mining Surveyors' Reports*, October, 1860, p. 293, vol. III.

The shallow diggings within this area were exceedingly rich, and the old ground still gives employment to many puddlers.

At Pickpocket, where the ground is from twenty to twenty-five feet in depth, the Chinese for a long time found profitable employment. They turned over the whole of it, and washed every part that gave any indications of being auriferous.

Nuggety Creek, lying to the south-east of Fryerstown, has high and precipitous ranges on each side, with huge rocks projecting from the surface. It has been carefully worked, and numerous large lumps of gold were found in the drift.

At Church's Flat, upon a surface hill, the diggers washed a foot in depth of the dirt, consisting of three inches of black loamy soil, and nine inches of drift and gravel, in which occurred here and there large boulders; and pieces of gold, varying from $\frac{1}{2}$ oz. to 2 ozs., were frequently found with the finer gold-dust.

Commissioner's Flat was from time to time energetically worked by both Europeans and Chinese, and a great quantity of gold was obtained from it. The depth of sinking is from twelve to eighteen feet, the strata consisting of black loamy soil, loose drift, gravel, and boulders; and the gold is nuggety.

Windlass Hill was very rich. The older drift is covered by recent alluviums, and two distinct strata of auriferous drift were found, one overlying the bed-rock (silurian sandstones, &c.), and the other the denuded surface of the older drift. The depth of sinking is from sixteen to twenty-five feet; in the north-western side the diggings getting shallow, and again extending into deeper ground. This part was the richest. The north-eastern and eastern sides vary in depth from seventeen to twenty feet, the gold being found in the slate and sandstone and in the overlying gravel. The hard sandstone bottoms were the richest, and in many cases the gold was found to have penetrated as deep as three and four feet in narrow crevices. The slates and decomposed mudstone and clay bottoms were not rich as compared with the other harder sandstone bottoms.

The upper auriferous stratum was generally richer than the under older drift, but it was found that this was due to the younger layer having derived its gold both from the detritus of reefs, and the breaking up of the auriferous stratum of the older drift.

Nearly all the gullies which have been opened in the Fryer's Creek division have been worked again and again, and yet they still give employment to 2,380 alluvial miners.

The Taradale goldfields are situated on the Back Creek, a tributary of the Coliban, and include numerous rich quartz reefs, and deep leads underlying basalt. The shallow alluviums are relatively unimportant, though many rich patches have been found in some places.

The basin of the River Coliban throughout its extent is more or less auriferous, and the manner in which the old palæozoic rocks are exposed, by the denudations which have swept away the basaltic lavas, enables the miners to get at the gutters of the deep leads with comparative ease.

The first great rush to Taradale took place in the early part of 1855, and at that time Yankee Point and Liberty Flat were the most attractive localities.

Gold had been found at the Back Creek as far back as July, 1852, but for a long time the field was neglected.

In the shallow diggings the sinking varies in depth from mere surfacing to thirty feet.

One large nugget (648 ozs.) and several smaller lumps of gold have been found in the drifts with the finer gold.

The Hepburn goldfields are situate on the southern sources of the River Loddop. Jim Crow Creek—the main stream—and all its tributaries are auriferous, and many smaller creeks to the eastward support a numerous mining population. When describing the deep leads, the physical character of this country will be to some extent illustrated. It is sufficient to say that the streams generally intersect claystones and sandstones of the same character as those found at Castlemaine. They have cut deeper valleys—escarpments are numerous—and in many places the miner is confined to the narrow strip of alluvium on one side of the creek only.

Sailor's Creek, Wombat, Spring Creek, Yandoit, Middleton Creek, Kangaroo Creek, and many small gullies have in times past been remarkable for great yields of gold from quite small areas, and there is scarcely one of them which does not even now remunerate the industrious miner.

In the beds of some of the streams which intersect or have their sources near auriferous quartz reefs or old *leads*, the miners found sometimes as much as 70 and 80 ozs. of gold in the space of a few feet; and it was generally easy to discriminate the gold derived from the reefs and from the *leads*—that from the reefs being coarse and heavy, and but little water-worn, and that from the *leads* fine and much rounded.

From time to time new ground is opened, which gives from 1 dw't. to 3, 4, and 5 ozs. per tub.

The old ground has been worked so often that vast quantities of sludge have accumulated in many places; and when sometime back a flood carried away much of the sludge and tailings, and opened new courses, the miners took advantage of the changes thus effected and worked the lower stratum, which was found to contain a great deal of fine gold. They made from 12s. to 15s. per diem for a long time.

There are few records of the yields from the claims when this goldfield was first opened; but the old miners well remember that, having once explored the thickly timbered and irregular ranges in this part, they were sure of finding claims where gold was to be got in handfuls.

At the present time one may see, any day, groups of Chinamen steadily pursuing their labors in the midst of dirty water and deep sludge, carefully rewashing stuff which has passed through innumerable cradles and puddling machines, and yet finding sufficient gold to enable them to live, after their fashion, and to save money.

The Tarrangower Creek and some of the western tributaries of the Muckleford Creek are highly auriferous. The gold workings lie immediately to the east of the inner western bend of the horse-shoe shaped mass of granite which encompasses Castlemaine, and the rocks are everywhere intersected by rich quartz veins. The alluviums have been very rich, and many large pieces of gold have been found.

The gold is sometimes found on the granite; and the strata and the underlying washdirt are not quite similar in such cases to those overlying the sedimentary rocks. There is an intermixture of granite *débris* and decomposed granite.

In some of the gullies fine topazes have been found with the gold; and the Government Geologist and Mr. Ulrich, Field Geologist, have given much careful attention to the localities where gem stones occur, and have caused to be explored some of the gullies with good results. Very good topazes and some amethysts have been thus obtained, which are now in the collection of the Geological Survey.

It is scarcely incorrect to say that the valley of the River Yarra, from its most eastern sources in the Baw-Baw Mountains to its embouchure in Hobson's Bay, is auriferous; and Melbourne itself is built on palæozoic and tertiary rocks, which are undoubtedly of the same character as those which in other places are washed and

puddled and crushed by the gold miner. It is not probably in every part worth the attention of the miner, but the sands of nearly every tributary have yielded gold, and the auriferous quartz reefs are so near Melbourne as to place it beyond doubt that every tide bears away some small quantity of gold.*

Anderson's Creek, Caledonia, Britannia, Starvation Creek, Wombat, and many other creeks and gullies, have given employment to many miners for a long period, and there are still large areas quite untouched.

* Mr. C. F. Nicholls drew attention some time back to the character of the bed of the River Yarra near Richmond, and having suggested that probably a lead of gold would be found there, much interest was at once exhibited. All the available lands in the valley were applied for under the leasing regulations, and a shaft was sunk at a considerable expense; but nothing definite was ascertained—though, at a critical period in the affairs of the company, gold was found at the bottom of the shaft. In the sample shown to me I noticed a fine crystal with the edges scarcely worn, and a ragged piece which had been cut with some sharp instrument. No doubt the gold was washed out of the dirt taken from the bottom of the shaft—but the sample I saw was remarkable, certainly. The failure to establish a mining company, however, in no manner invalidates the statements on which Mr. Nicholls' theory is founded. He says:—"The probability of a deep lead round Melbourne was pointed out by me in the *Ballaarat Star* newspaper, February 23rd, 1862; and on May the 29th I corroborated what I had previously written, having found a coarse speck of gold in the gravel at Studley Park, on the high ground, and examined the bed-rock or slate reefs forming the south bank of the Yarra, and the opposite reef on the north side, cropping out on the edge of the basaltic flat. I was first impressed with the fact of deep ground being in the vicinity of Melbourne by inspecting, by accident, the cutting on the south side of Chapel-street Bridge, Richmond. Afterwards I ascertained that the bluestone (basaltic rock) had been quarried to a depth of about thirty feet without showing any indications of giving out; and, on inquiry, was informed that gold had been obtained in small quantities in the alluvial drifts of North Melbourne, at the Flagstaff Hill, at a sawpit at Emerald Hill, at St. Kilda, on the footpath Hoddle-street, in gravel brought from Studley Park, at Greville-street Station, at Chambers' Foundry, Prahran, on Batman's Hill, and on Richmond Hill, near the Hawthorn Railway cutting, in sinking the cellar of Mr. Hancock's house, and by the same man in cutting a drain on the opposite side of the Yarra River, on Colonel Anderson's land. The examination of the bed-rocks in the neighborhood led me to the conclusion that they were of the same character as those of Ballaarat and other goldfields of which I had had personal experience. The presence of basaltic rock and its situation, apparently filling in the valley of the Yarra round Melbourne, led me to the conclusion of the existence of deep ground; and an examination of the outcropping slate reef proved to me that this deep ground was easily to be traced for at least ten or twelve miles eastward from Prince's Bridge. The finding of gold by myself and by others, as above stated, and the character of the bed-rocks, led me to the conclusion that the deep ground was auriferous and probably rich. The only adverse peculiarity of the bed-rocks was the absence of quartz, as far as I could see. Since the date referred to a quartz lode has been constantly worked at Diamond Creek, and has, I am informed, yielded about 1 oz. to the ton of stone. The creek is, I believe, a tributary of the Yarra. At Boroondara the late Mr. P. H. Smith, informed me that there was a quartz lode on his farm, out of which gold had been taken. These facts, taken in connection, that Anderson's Creek is a tributary of the Yarra, and that all the sources of the Yarra are traced into auriferous hills or mountains, bear out the inference I have drawn. The sample of gold obtained by me I placed in the hands of Dr. Evans, then Minister of Mines. At Collingwood a shaft was sunk on the basaltic flat, and bottomed, at about 130 feet, on a greenish slate reef, very like the Gravel Pits slate reef of Ballaarat. I saw, with a number of others, several buckets of reef-dirt brought up out of the shaft, and eight or nine dishes of that dirt washed—in all of which a little gold was found. I had nothing to do with the company that sunk the shaft, nor am I fully acquainted with the causes that prevented the ground being properly tested. I sank a shaft on the hill at Studley Park, by permission of Mr. C. Gavan Duffy, then Minister of Lands; but I did not find the bank of gravel, in which I found gold, continued into the hill. The shaft was about fifteen feet deep. I found narrow quartz veins, but no gold. The gold discovered in Mr. Hancock's cellar was coarse and heavy. It was got in soft white pipeclay, and in seams or pockets, in the usual bed or slate rock. The amount was 3 or 4 dwts., and it was sold to Mr. Davies, gold broker, Elizabeth-street."

It was observed by Mr. Murphy, formerly mining surveyor for this division, that at and near Anderson's Creek the right bank of the river, and also the right sides of gullies of any considerable length, are always very precipitous, and different altogether from the easy slopes of the left banks. This is more observable in places where the trend is westerly, and is due probably to the position of the rocks. These dip at high angles, and accordingly as they are intersected by any stream, in the line of the strike or at some angle approaching a right angle, the banks will be equal or unequal in their escarpments.

Many attempts have been made to work the bed of the Yarra. It carries a great volume of water to the sea; and whenever an attempt has been made to divert the course of it the miners have met with many difficulties, and it has been necessary to incur great costs for the preliminary works. In those parts where the stream forms a peninsula the mode has been to cut an open channel across the isthmus, or to form a tunnel at such a level as to lay bare the old bed of the stream—but the most considerable of the works have been attempted only to be shortly abandoned.

Many of the gullies and small streams near Anderson's Creek and Caledonia have been very rich, and even now there is not one that will not well remunerate an industrious man, who can bring to the work skill and energy, and some knowledge of gold mining.

Respecting the shallow alluviums at Taradale, Clow's Forest, Blue Mountain, Tubba-Rubba Creek (in the county of Mornington), and Emerald,* there is not much interesting information available.

* In the heavily timbered and very scrubby country within the watershed of the Woori-Yaloak (a tributary of the Yarra), there are lofty ranges, composed of felspar porphyry, abutting on upper silurians, and near the junction, a goldfield, known as the Emerald, was discovered, in the early part of 1859. In the month of February of that year it was visited by Mr. Clement Hodgkinson, and from his report, which was laid before the Legislative Assembly, the following extracts are taken:—

"The gold workings are situated on one of the fine permanent streams (not at present surveyed or shown on any map), which combine to form the western branch of the Woori-Yaloak River. The rock in the ranges and ravines contiguous to these streams is generally felspathic porphyry; but the bed of the auriferous stream displays blue shale, appertaining to the palæozoic series of rocks, although the tract of country in the midst of which this stream occurs is all colored as porphyry. In the upper portions of some of the other streams which combine to form the western branch of the Woori-Yaloak, I noticed shingles and pebbles of felspar, quartz, porphyry, and black carbonaceous shale.

"Near the junction of the auriferous creek with another larger creek, four temporary stores have been constructed of calico, and the main encampment of the miners formed. The stream of the auriferous creek above the junction just alluded to has been diverted from its bed for a considerable distance, and used for sluicing the quartzose gravel and soft blue shale dug out from the claims in the bed of the creek. These claims, for a short distance up the creek, appear to be highly remunerative: for instance, a very energetic and persevering miner, whom I had formerly known at Anderson's Creek, informed me that he and five others had washed out seven ounces on the 16th instant; and on the 17th instant I myself watched their operations for about half an hour, and saw enough coarse gold obtained in that short period to give promise of a very favorable return for their work on that day also. At another claim higher up the creek, the owner showed me a nugget, weighing about one ounce, which he had obtained in a pocket of the blue shale. The ground at present known to be remunerative is, however, of very limited extent, and appeared to have been all taken up at the period of my visit."

The country towards the east, north, and north-west is auriferous; and, in nearly all the stream beds flowing northwards to the River Yarra, gold and tin ore are to be obtained, but the district is wholly neglected by the miner. Though the timber is heavy and the scrub dense, there are now

+ The mining district of Ararat is bounded on the east by the Ballaarat District; on the north by the Main Spur to the western rim of the Amphitheatre, and thence by the range which forms the basin of the River Wimmera to Heifer-station Creek; on the north by the Heifer-station Creek and the road to the River Wimmera to the point where that river bends to the northward, and thence by a line west to the western boundary of the colony; on the west by the 141st meridian; and on the south by the sea.

The principal goldfields are Ararat, Armstrong's, Great Western, Pleasant Creek (Stawell), Moyston, Barkly, and Fiery Creek (Beaufort).

The greater part of the area is occupied by basalt and basaltic lava. The isolated patch of older palæozoic rocks west of Wickliffe encloses quartz reefs, but nothing has been done to show whether or not the area is rich enough to support a mining population. A large tract towards the north is occupied by upper or middle palæozoic rocks, with an exposure of granite east of the Victoria Range; and still further west there is a larger mass of granite rising in the centre of a great area of gneiss and mica schist,* where up to the present time no gold has been found.

The goldfields of Ararat, whether in regard to their productiveness, extent, or interest to the geologist, are inferior in importance to the gold workings of other parts of the colony. They have, however, not been as carefully described nor as well illustrated as other parts; and there is less information available respecting them than, even having regard to these circumstances, might have been expected.

The areas occupied by the miners are of interest, not so much because of what has been discovered there, but as showing what may subsequently arise out of the discoveries. Touching as they do the north-western marge of the extensive basaltic plains which reach uninterruptedly from the River Yarrowee to the base of the Mount William Ranges, they suggest that hereafter the miner will explore and discover leads, probably as valuable as any developed at Ballaarat, over the whole extent of the area covered by the volcanic rocks which extend from Mount Cole on the north (where there is an outcrop of granite), to near Lake Elingamite on the south (which lies within the boundaries of the miocene tertiaries). East and west, and north and south, for more than seventy miles in each direction, there is country which is as surely auriferous as any part of the known well explored gullies of Castlemaine or Sandhurst; and it is, as yet, unexplored, untouched. It is worthy of note, that wherever there occurs within a basaltic area, even a small patch of exposed silurian rock, the miner surely finds gullies containing gold, and reefs of auriferous quartz. The small outcrop at Raglan has long given employment to many miners; the patch west of Wickliffe is more or less gold-bearing; and far away to the south, on the extreme western boundary of the carboniferous rocks, we again find gold. These facts are sufficient to warrant a belief that the great plains will hereafter be occupied by the gold miner; and that under them, on the sculptured surface of the older sedimentary rocks, he will find the same leads and the same drifts as occur at

many cleared tracks in various directions, and persons could prospect the alluviums without encountering serious difficulties. Much was done under Mr. Hodgkinson's direction, and by the Prospecting Board, to open up the country; but its rich soils, perennial streams, and delicious climate are not sufficient to attract to the spot those who vainly seek employment in the streets of Melbourne.

* Mr. A. R. C. Selwyn, Government Geologist.

Ballaarat and Raglan. If this be so, it is not incorrect to say that gold mining is but in its infancy in Victoria, for once let these plains be opened, and there would be room for all the miners of England.

The goldfields of Ararat proper are situate on the eastern slopes of the Mount Ararat Range, which is a small spur of the Coast Range. They lie close to a tongue of basalt, protruded from the plains northward in the direction of the basin of the River Hopkins. On the north-western slopes of the same spur, many auriferous gullies and creeks—tributaries of the Concongella Creek—form a distinct goldfield. The more important localities on the south-eastern side, all of them trending towards the River Hopkins, are as follow :—Canton Lead, Deep Lead, Commissioner's Hill Lead, Upper Wet Lead, Blackman's Gully, Spring Lead, White Lead, Phillip's Flat, Gibson's Flat, Black Hill Lead, Nil Desperandum Lead, and numerous gullies and flats trending towards these.

Immediately west of the One Tree Hill, on a watercourse falling towards Moyston, there are Opossum Gully, Porcupine Gully, Parker's Lead, Square Shaft Gully, A 1 Lead, Salvation Gully, White Lead, Wattle Gully, and many others trending towards the Port Curtis Lead.

On the north the more important tributaries of the Concongella Creek are Snake Hill Lead, Centipede Gully, Dutton Gully, Napoleon Lead, Hospital Gully, Pike's Gully, Johnston's Gully, Eaglehawk Gully, Long Gully, Garden Gully, Jonathan's Gully, and numerous wide auriferous flats. Further to the northward are the goldfields of the Great Western and the Great Western Lead.

The tributaries of the Sugarloaf Creek are also auriferous.

In another place very interesting statements are given respecting the character of the deep leads in this district.

The Mining District of Gippsland is bounded on the north-west by the Main Dividing Range, from St. Clair on the west to the most eastern sources of the Kiewa Creek on the east; thence by the range separating the waters of the Kiewa Creek from those of the Mitta-Mitta to Mount Nelson; thence to Mount Wills; thence to Mount Cooper; thence to Mount Gibbo; and thence by the Gibbo Range and a line south-easterly to Forest Hill; on the north-east by the boundary of the colony; on the south and south-east by the sea; and on the west by the boundaries of the Mining District of Castlemaine.

Amongst the many mining localities we find Jericho, Donnelly's Creek, Stringer's Creek, Fulton's Creek, Hawthorn Creek, Icy Creek, Pheasant Creek, the Red Hill Diggings, Crossover, Hoddle Range, the tributaries of the Mitchell River, including the Wonnongatta, Humffray, Crooked, Dargo, Wonnongarra, and Wentworth Rivers, together with their numerous feeders; Omeo and the heads of the River Mitta, the Nicholson River, the River Tambo, some of the tributaries of the Snowy River, and the River Delegete.

Shallow alluviums containing gold occur on all the tributaries of the La Trobe, whose sources are in ranges composed of palæozoic mudstones and shales. Red Hill, Shady, Hawthorn, and Camp Creeks, and other small gullies and watercourses have given employment at various times to many small parties of miners, who have earned frequently as much as £5, £4, and £1 per week per man. The ground in these places is patchy, and a regular persistent stratum of auriferous earth is not generally found here as in other places. The clivity of the watercourses has something to do with this—where the ground is alternately steep and flat, and where small waterfalls and ripples caused by hard ledges of rock are numerous, regular layers of washdirt are

not looked for. This part of the colony has been but imperfectly prospected, and it is highly probable that drifts older than those found on the banks and in the beds of the streams will be discovered lying on the slopes of the ranges. This, however, is merely a supposition founded on the known character of the rocks and the streams. It is the custom of the miner to look for gold only in places where former experience has taught him that it is likely to occur—for the good reason that he has, as a rule, neither time nor opportunity to pursue investigations which may not result in immediate profit. A proper direction once given to his energies, he never flags; but he properly refrains from laboring in places where the arrangement of the rocks is different from that observed in localities with which he is acquainted.

The streams flowing southward to Corner Inlet, and having their sources in Hoddle Range, have yielded gold. The Tarwin in its upper parts and other neighbouring streams not named, which cut through palæozoic rocks intersected by quartz veins and lying close to the coal-bearing strata, are auriferous, and the sands which they carry to the sea contain small particles of gold.

But little has been done to open up this part of the country. The alluviums were not very rich, and the hard dense and rather poor quartz was not tempting. There is a very large area lying to the north of the Hoddle Range which is almost unknown to the miner, and which yet presents features highly favorable to the supposition that it will be found auriferous.

The Jordan, Red Jacket, Blue Jacket, and B.B. Creeks, tributaries of the River Thomson which has its sources in the Great Range, have been highly auriferous—and these, with the Aberfeldy River, Donnelly's, Stringer's, and Fulton's Creeks, yield annually a considerable quantity of gold. Exceedingly rich patches of gold-bearing drift have been opened in these places, and a great many nuggets have been found. But the drifts are not deep nor extensive. All the area drained by the River Macalister right up to the Snowy plains is yet open to the miner, and is almost untouched; and it is not until we come to the sources of the Wonnangatta and the Humffray, the Moroka, the Wonnongarra, and the Crooked Rivers that we find gold workings. The great basin of the River Mitchell from Prospect Creek, within eight miles of Lake King where the river has its embouchure, right up to its source in the Cordillera, and from its extreme western tributaries in the Snowy plains, eastward to Mount Birregun—altogether an area of more than 1,000 square miles—is auriferous. In the valleys where the alluviums occur, or in the ranges where veins of quartz crop out to the surface, we everywhere find gold.

The Wentworth, the Dargo, Mount Pyke Creek, Jungle Creek, Hope Creek, and Good-luck Creek are well known to the explorers and miners who have opened up this tract.

The Nicholson River and the Tambo River, which discharge into Lake King, are in nearly all parts of their course auriferous.

Eastward lies the Snowy River, respecting which but little information is available.

All the country lying between the Snowy River and Cape Howe is occupied by palæozoic rocks, intersected by veins of auriferous quartz; and cropping out above the sedimentary rocks are masses of granite wherein occur numerous dykes of diorite. Except that the low lands are swampy, this area differs little from the ordinary palæozoic country. Shallow auriferous alluviums form the beds of the gullies and creeks, and steep sharply-cut ranges divide the watercourses. The strike of the rocks is nearly north and south, but the lines are in many places deflected as is common elsewhere.

It offers an immense field to the prospector, and thousands of persons will hereafter settle on the waste lands in this part of the territory, and turn to profitable account the million and a half of acres which for years have lain neglected.

Mr. Alfred Howitt, the Police Magistrate and Warden at Bairnsdale, has lately visited the goldfields on the extreme verge of the colony, and reports as follows:—

“I have just returned from a visit to that portion of the division under my charge, lying between the Snowy River and the boundary of New South Wales.

“For some time past it has been reported to me, at intervals, that discoveries of auriferous quartz, and new alluvial gold workings had been made, but it was only in the latter part of January that I was able to visit the locality of these discoveries. I may shortly sum up the country lying on the line of road from Bairnsdale to the crossing of the Snowy River, at the Turnback Mountain, by stating that it passes over miocene formation to near Buchan, limestone on the Buchan and Murndale Rivers; and on leaving the latter a trap table-land, including Gelantipy and Wooloogomerang, and sloping towards the Snowy River, of which it forms the western watershed. I did not see any inducement for prospecting, excepting perhaps in a small belt between Boggy Creek and Buchan, where apparently the porphyry extends from Mount Nowr-Nowr. At Wooloogomerang the track to the Dedduck, Delegete, and Bendoc Rivers turns off, and after descending by a long spur and two steep pinches, crosses the Snowy River, at a rocky ford just below the junction of the Dedduck. I may here remark that this river is, in different parts of its course, called the Dedduck, the Tubbut, and the Bonang. The mountains on the Dedduck appear to be principally schist and granite, with but faint traces of quartz veins. The scenery is very grand at this point, but enjoys a climate in summer more in accordance with the Riverine territory than with Gippsland; the hill sides are burned to a red color by the sun, and what little grass there is, is perfectly bleached and dry. Pines, curry-johns, and portulac, grow in the river.

“It is only in reaching the upper part of the Dedduck, there called the Liprail, or Bonang River, that the country improves as regards gold working. It is almost identical in its formation and appearance with Omeo; and it is on the Upper Bonang that two of the reefs discovered are situated. Alluvial workings have also been carried on by Chinese, but they are now abandoned, as I was given to understand, because of the depth of sinking, and the underground water. I can well understand that such is the case from the appearance of the swampy flats through which the Bonang winds its course.

“One of these reefs I did not inspect, the report not being satisfactory, and my time short. The second reef, named the Rising Sun, I visited: it is situated on a low watershed, near the Bonang, and is surrounded by a dense jungle of musk, fern-trees and other scrub, interlaced by vines. The reef, at present, has a shaft, sunk about twenty feet; and at a little distance a small excavation has been made in the reef; and a small leader is visible near the shaft. The reef, as now opened, runs N., 70 W., underlying considerably to the north, the leader being N., 20 E., with a westerly underlie. The reef having been broken down in the shaft, very plainly shows its present dimensions and character. On the western side of the shaft it is well defined, but varies from ten to fifteen inches; on the eastern side it is completely pinched out, only showing its course by a narrow vein of clay; at the bottom of the shaft it, however, shows signs of remaking. The quartz appears to be in a greasy light-colored slata. The stone shows fine gold, and, I may remark, in anticipation of a subsequent part of this report, has a better appearance than the quartz visible elsewhere, for

instance, between the Delegete and the Bendoc Rivers. A sample of gold, said to weigh an ounce and a quarter, has been shown to me by the Messrs. Marriott, who are interested in this reef, as having been washed out of the rubble taken from the first shaft. I give this statement simply as I received it; but while there I saw a small pan of rubble knocked out and washed, which certainly gave a very fair show of loose gold.

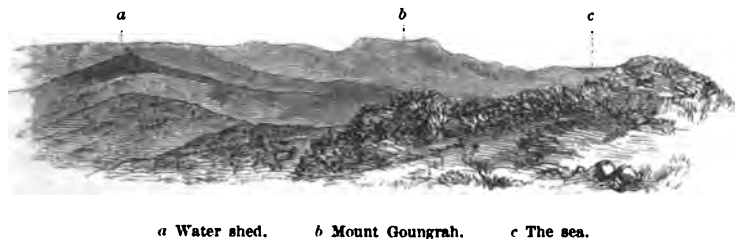
"Altogether I consider the appearance of this reef so far favorable that it proves that auriferous quartz veins exist in the neighborhood, and although not rich, they may probably be worked to advantage ultimately. Difficulties will, however, be met with from underground water, want of fall in the rivers, and the boggy nature of the flats. I question whether any of the level ground would bear machinery at work without giving. Leaving the watershed flowing into the Dedduck, an easy road leads across the divide between these streams and the Delegete River. Here, again, the resemblance to the Omeo country is most striking. On the Upper Delegete, I saw one party of Chinese at work, who had constructed a flood-race of considerable length, calculated to carry all the Delegete River. I was unable to ascertain what they were making, but judging from their work, I should conclude it must be satisfactory to them. Following the Delegete down its course to where the boundary is supposed to cross, the country becomes more open and well grassed, with Mount Delegete prominently on the right, rising out of a low undulating country, covered with dwarf white gums. I did not observe any workings, but I do not see any reason why the ground on the Delegete should not pay for working. Leaving the Delegete River at this point, a track crosses to the Bendoc, a small stream winding through swampy flats, and among the low hills surrounding the Mount. Here, as elsewhere, the greatest uncertainty prevails as to the boundary, and it appears that every one adopts that view which accords best with his wishes and interests; whether he is desirous of being in New South Wales or Victoria.* I was given to understand that on this river, and immediately on the supposed boundary, is a colony of Chinese, numbering probably 300. On the upper part of the river I visited one Chinese claim, but was unable to obtain any information from the men at work. Judging, however, from appearances, and from the work done, I should say that they had been at work for probably two years, and should put down their wages at from 30s. to £3 per week. A little distance higher up are other Chinese parties, and on the opposite side of the river, on a low range, is situated the Morning Star Reef. The work here, as regards the shaft, has been well done, but I cannot say that I saw much in favor of the reef. It has been followed down for about forty feet, but neither it nor the rock appears to be even there formed. It seems to be bedded in sandstone, and I failed to discover more than a little fine gold in the stone raised. However, as I have already said, in speaking of the reef at Bonang, it may be regarded as so far encouraging in being an inducement to prospect a perfectly new district. I observed signs of quartz reefs in various places. Besides these workings, I received information that a number of miners had been for some time at work at Nicholson's Bog, about thirty miles southeasterly; and at the time of my visit, a new creek working had been discovered about the same distance on the Victorian side of the supposed boundary line; it is named Goungrah Creek, and I understood that about thirty European miners were located

* The boundary, at this part, between Victoria and New South Wales, is a straight line across country from Cape Howe to the nearest tributary of the Murray. It has not yet been accurately set out.

on it. I met one or two parties on their way from Twofold Bay, and on my return several from Gippsland. Shortness of time prevented my visiting it, but from the conflicting accounts given as to its value, I am inclined to believe that it has yet to be thoroughly tried, and I conclude that it will be found to be one of the streams following into the Brodrib River. I was informed that its course is nearly south.

"Reviewing the country I have personally visited, I arrive at the opinion that a large extent of country will be found immediately on the boundary line which, without being rich, will probably support a considerable mining population; and, further, that it affords a good field for prospecting. I should particularly point out the sources of the Bonang, Delegete, and Bendoc Rivers, and all the streams flowing southward from their heads, and probably falling into the Genoa, the Bewm, and the Brodrib. The ranges at the head of the Bonang and Delegete, as far as I saw them, change to sandstone and slate. Downwards from the Bonang, where the river is called the Tubbut, is not favorable, the river drift being granite, metamorphic rocks, a few traces of hardened slate, and a marked absence of quartz. The view from a spur of the Coast Range, forming Mount Goungrah, as seen from the summit of Mount Bowen (Fig. 10), gives a fair idea of the structure of this part of the country.

FIG. 10.



a Water shed. b Mount Goungrah. c The sea.

"In the country between the Delegete and the Bendoc Rivers, and on the low hills round Mount Delegete, there are many traces of quartz drift; but those reefs which I observed cropping out on the surface were extremely hard, compact, and of a dark blue color. It might be worth prospecting, as water could be brought, I anticipate, without much difficulty. A very great drawback to the working of the Delegete and Bendoc, in this flat country, is their want of fall, and the consequent necessity for pumping and passing everything through boxes. I estimate the present population, both squatting and mining, at about 500. Probably rather more of the workings at Goungrah are proving successful.

"The distance from Bairnsdale is about 150 miles, and the road, taken as a whole, very good for the mountains."

Since the above report was received Mr. Howitt has made further explorations in the north-eastern portion of the Victorian territory. His reports, dated June, 1868, are as follow:—

"I have the honor to report that I have, during this month (June) from the 10th to 14th inclusive, visited the goldfields situated in East Gippsland, immediately adjoining the New South Wales boundary.

"I find some improvement since my last visit in the prospects of the goldfields, and an increase in the population, attracted by the auriferous quartz reefs discovered on the Bendoc and Bonang rivers. At the former place a small township, known as

Wagra, is rising round the Phoenix quartz crushing machine, erected by a Mr. Eisenstaedter, of Melbourne. One or two public-houses are in course of erection, with the usual butchers' shops and a store; and what is somewhat unusual, in such an early stage, a school has been established, at which I found thirteen children assembled.

"The machine erected here is rather calculated for prospecting than for actually working the reefs, but seems well constructed and to work smoothly, and to have the latest improvements for saving the gold, including sodium. The battery consists of five stamps, said to be of 4 cwt. each, but looking scarcely that weight. It is driven by a sixteen-foot iron overshot wheel, supplied by a race taken from the Bendoc, which at present I may say contains scarcely more water than is sufficient to drive the machine at half speed—that is some three heads according to the Gippeland gauge. I am informed that, when at full work, it is expected to crush thirty-five tons per week.

"At the time I visited it, it was crushing for No. 1 North Morning Star Reef, but had not completed the seventy tons raised, and I was unable to ascertain even what the expected result was. From the appearance of the stone, I should say it was under an ounce. About 400 yards westward from the machine, in gently rising ground, is situated the Morning Star Reef, of which I spoke in my last report. The prospecting claim, and Nos. 1 North and South, are being worked. The stone from No. 1 North was, as I have said, being crushed. The prospecting claim I judge to have about 100 tons of stone raised. The prospecting shaft is now down 110 feet, and is at water level. The stone seems less rubbly than when I saw it last, and varies in width from three feet to six inches. From its appearance I should not judge the returns to be more than 15 dwts.; but I am informed that the first crushing, with the original wooden machine, produced 1 oz. per ton, and that the tailings which were then saved, and since passed through Mr. Eisenstaedter's machine, have returned 7 dwts. in addition, thus bringing up the stone to 1 oz. 7 dwts. per ton; but I have no means of verifying these statements. Should this prove correct, I have no doubt that these reefs will pay for careful working, as no powder is required in getting out the stone, the pick and gad doing all that is necessary; and I may now say that all the reefs I have seen at Bendoc are found in very soft yellow and light-blue slates and sandstones, more resembling the formations of the older goldfields than those of Gippeland. I have no data on which to found an opinion, but it has suggested itself to me whether the Bendoc goldfield may not belong to the upper silurian.

"The reefs are generally nearly meridional, with a slight dip to the west. I annex a tabular statement of particulars relating to the reefs, and beg to refer to the map for their positions. Later in this report I shall have occasion to express an opinion on the probable extension of this goldfield.

"Westward from the Morning Star Reef is the 'Come Love,' which has been discovered by a party from Boggy Creek (near Bairnsdale). The appearance of the reef differs in no way from that of the Morning Star; and stone is now being raised for crushing, so soon as the machine, which has been purchased, and which I am informed is landed at Twofold Bay, shall have arrived. The funds with which this machine has been purchased have been raised principally in New South Wales (Bombalo) by the issue of scrip, and I fully anticipate, from the mode in which this has been done, that litigation will arise if the reef prove successful.

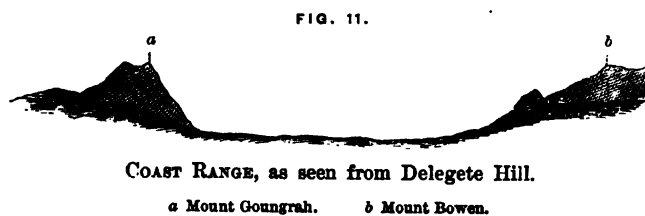
"Particulars relating to the other reefs will be found in Schedule A.

"Before proceeding to other matters, I may state that no further crushing has been made at Marriott's Rising Sun Reef, Bonang River. A new machine site is now being got ready, and I understand from Mr. Marriott that he intends still to crush with the machine he made himself, until he has realized sufficient to purchase a battery, and the necessary mechanism for amalgamation. He has been for some months raising stone, and now estimates that he has mineral of the value of £400 at grass. No. 2 North and South are being worked by parties, but neither have yet struck the reef. The average of Marriott's Reef has been a return of 23 dwts. per ton, and no doubt that with such very imperfect machinery as they use much is lost. In the neighborhood of Marriott's the Bonang Reef has been re-occupied. It is supposed to crush about 10 dwts. per ton.

"In alluvial mining very little has been done, and I am not aware that any new places have been opened. A few Europeans, and perhaps 250 Chinese, constitute the alluvial mining population. About twenty-five Chinese have lately crossed the coast range to Goungrah, where they are working. I have annexed, in Schedule B, a statement of the population of the district; and, in connection with this subject, I may state that I found miners working on the reefs from Boggy Creek, the Nicholson River, Shady Creek, and the Wombat Creek; from which I conclude that it is only necessary that the crushings should prove remunerative for numbers of their mates from these places to join them.

"At present the great want at Bendoc is not only capital, but I believe actually, with many, the means of living. The miners are deeply in debt, and are depending on the reefs. Should these prove unsuccessful, it will be long before the district recovers sufficiently to admit of the opening up of other portions where auriferous quartz may be searched for with a probability of success; and yet, poor as the miners seem to be, there are extensive tracts of country on the Bendoc, Delegete, Queenborough, and Back Rivers which promise well for alluvial workings, and yet are untried.

"The geological features of the Bendoc and Delegete goldfields are interesting, and I shall, as concisely as possible, endeavor to furnish such information as I have been able to gather during my visit. As will be seen from the map they are situated in a tract of country bounded on the south-east by the Coast Range and on the west by the mass of mountains lying between the Delegete and the Snowy River, of which mountains Tingy-Ringy is the highest point. This goldfield is, in fact, situated in an extensive granite trough, which rises above the surface on the east as the Coast Range, showing a level outline for many miles, and ending southward in a high mountain (Goungrah) which I may describe as a promontory jutting out above the headwaters of the Goungrah River. As the summit of the mountain at a distance of fifteen miles shows huge masses of rock, it is probably granitic. On the western side the granite does not



form any connected ridge throughout the whole of the north and south extent of that boundary of the goldfield, but appears almost universally in the beds of the creeks, and at various elevations, up to the Tingy-Ringy Range, which

is its culminating point, in places. On the fall into the Delegete River, from the west, it is seen alternating with changed silurian rocks, which in several places in the deep gullies can be seen resting as a dislocated capping on decomposed granite. To the south-west this is still more apparent, in the broken country on the Tubbut River, where the high ranges are found to commence with granite and granitic rocks at their bases, as shown by the river beds, and gradually rising through rocks less and less altered, until near the summits the silurian rocks can be perfectly recognised, and are but slightly changed. The crest of the mountains is generally defined by a ridge of highly crystalline quartzite. Throughout all this country trap and porphyry dykes have burst through the strata on all sides, adding their part to the general disturbance. In two places I have seen ancient gravel beds at from 500 feet to 700 feet above the river level, preserved by cappings of basalt.

"The drainage area of the Upper Bendoc is a low undulating country, sloping gradually back to the Coast Range, which between the end of Mount Bowen and Mount Goungrah dies away into low ridges, among which the headwaters of the Bendoc, the Delegete, the Bonang, and the Goungrah interlock. The Bendoc rises in swampy flats, and throughout its course in Victoria has but little fall, winding through alluvial flats, which occupy the spaces between the undulations of this basin. In this area the soft silurian slates and sandstones are almost vertical, having a slight dip to the west, and a strike of from N. 5 W. to N. 15 W. The low ridges between the Bendoc and Back Rivers are mostly covered with alluvium, containing both rounded and angular fragments of the rocks found *in situ*. I have not inspected the Back River or the Queenborough, but, from information I have obtained, I believe that the same formation continues until it abuts on the granite ridge forming the Coast Range. Northward, on the Bendoc, the rocks appear very little altered, until the spurs from Delegete Hill are reached, where a change is seen to commence.

"Delegete Hill rises some 1,500 feet above the surrounding country, and from some points has the appearance of a hill due to upheaval, but on examination it proves to be composed of the same silurian rocks as the surrounding country, but to be hardened at the northern end, and on the summit to be crested with a ridge of crystalline quartzite; the strike of the rocks on this hill at first follows the general meridional direction of the Bendoc, but on the northern end takes a more easterly direction, still maintaining a dip to the north-west. The whole of the hill is covered with masses of angular quartzite and altered slate. No doubt the excessive cold during the winter and the sudden changes at all times in this elevated plateau tend to fracture the surface rocks to a greater extent than is seen elsewhere.

"Northward of Delegete Hill is an undulating plain, in places lightly timbered, being the most south-easterly termination of the great Maneroo table-land. It is, as far as I know, quite untried, although gravel beds show themselves in many places. Here, proceeding westward from Bendoc Station to Delegete Station, successive undulations are crossed, rising to a low watershed and again falling to the Delegete River. At Bendoc the rocks are found altered and much harder than at Wagra, and on reaching Delegete the change becomes more marked—the strike of the rocks generally trending round to the east, although in places they are thrust in all directions, and the sandstones and slate beds alternate more rapidly with bands of flinty and jaspery rock of all shades of grey, blue, and red, until at the Delegete River these predominate and all traces of stratification are often lost in angular jointings which decompose the rock into hard rubble. At the Delegete House the granite appears crossing from a ridge, which is shown on the map, following

the Delegeete on the east bank and subsiding at the back of Hayden's. The contact of the granite and slate rocks has been laid bare by the river; the granite here shows divisional planes which run vertically in a strike of N. 10 W. and 15° from vertical to the north-west in a strike of N. 65 E.; a few yards further on following the line of contact, it enters the river bank, and here the hardened stratified rocks appear with the same strike and dip, N. 65 E. and 15° to 30° dip from the vertical to the north-west, overhung by the granite, between which and the altered slates a band of friable rock is intercalated, seemingly composed almost entirely of white felspar containing scattered double crystals of quartz with rounded angles (See Fig. 12). From almost all the rocks visible near this place it would seem that the original planes of stratification, as seen at the Bendoc Reefs, have been obliterated on nearing the granite at Delegeete.

FIG. 12.



a Friable felspathic rock.

b Altered slates.

From a sketch by Mr. Howitt.

"Near Bendoc Station

a high ridge is indicated running down the course of the Bendoc River, and on this range and in the river itself the soft slates and sandstones re-appear, being evidently a continuation of the same rocks which occupy the area of the Upper Bendoc and the Back River, and which, I have little doubt, cross the coast-range and extend down to Goungrah River, where there are alluvial workings. On the range I have spoken of as being near Bendoc Station, extensive reefs of ferruginous quartz exist, and will probably be found to be the source whence the gold has been derived which has been worked over a large extent on the Bendoc by the Chinese.

"Drawing an imaginary line from Delegeete Hill to the western end of Mount Bowen (which I have not been able to show on my plan, but merely the direction) and passing through Spring Gully Gap, I should indicate the area between it and the coast-range as containing both alluvial and quartz gold, and extending from the boundary of New South Wales southward down the Goungrah River; in the direction of the coast westward of this line I do not anticipate that any auriferous quartz reefs will be found, excepting, perhaps, in the small space around Spring Gully Gap where the silurian rocks extend further to the west. Almost in the line I have indicated, and about two miles westward of Marriott's Station on the Bonang River, the change of formation is indicated by a narrow table-land of trap; westward of which the broken country on the Tubbut River commences, and where I should neither expect to find alluvial nor quartz gold in payable quantities. Throughout that district which, I believe, extends beyond the Buchan or Native Dog River, plutonic action has been very powerful, and with the influence of innumerable trap-dykes and probably submarine volcanic action at Gelantipy, have exercised great influence in metamorphosing the overlying strata, and the conditions do not appear to have been favorable to the production of auriferous quartz reefs—or possibly, these reefs, if formed, may have been obliterated.

"I have annexed such sketches of the strata as appear to me to illustrate the geological features of the district I have reported on, and also a section from the coast-range through Delegete Hill, following a somewhat parallel course to the boundary line; the distances and heights are necessarily incorrect.

"Finally, I may mention one or two small matters which I believe I have omitted to refer to. I have indicated Chinatown as being situated immediately adjoining the boundary line and in New South Wales. At present it is extremely uncertain where this line may run, and although it is generally stated that such and such places are in New South Wales or Victoria, I have, except in clear cases, disregarded these statements, and not included such portions of the country on the boundary in my reports as seemed to me doubtful. I have therefore not included, for instance, Chinatown, where about 200 Chinese are living and raising gold from the Bendoc.

"I may also note, as illustrating the formation in the plains between Bendoc and Delegete, that at the former place I found a well which showed the following strata:—Soil, two feet; yellow clay, nine feet; ferruginous cemented gravel, two feet; water-worn coarse gravel of quartz and sandstone, four feet; pipeclay and clay containing fragments of the subjacent rocks, three feet; the bed-rock being slate and sandstone."

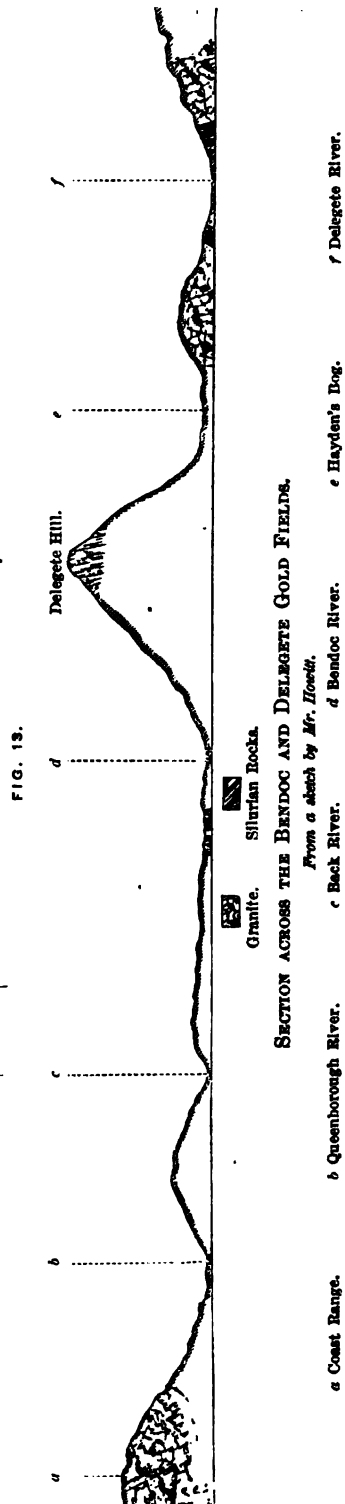
SCHEDULE A.

REEFS SITUATED AT UPPER BENDOC.

Name.	Depth.	Average Width.	Strike.	Dip.	Result of Crushing.
	ft.	in.	X		
Morning Star	110	21	North ...	Say 1 in 10 west	27 dwts.
Ditto, No. 1*	80	21	North ...	Ditto ...	Now crushing.
Come Love ...	50	26	North and south	1 in 17 west	No crushing yet.
Imperial ...	37	11	Ditto ...	1 in 5 north	Ditto.
Homeward Bound	...	...	...	...	...
Primrose ...	35	20	North and south	At surface dip 2, then 1 in 10 west	...
Britannia ...	30	20	North 15 east	1 in 10 west	...
United†	...	24	...	...	...

* Down to water level.

† Besides the main reef is a leader showing very good gold; and a shaft is now being sunk to cut its supposed junction with the main reef.



SCHEDULE B.
POPULATION EAST OF SNOWY RIVER.

EUROPEANS.					CHINESE.		Total.
Miners.		Various.	Women.	Children.	Miners.	Others.	
Quartz.	Alluvial.						
57	23	161	48	78	250	16	633

N.B.—The population of Chinatown, which is, most probably, in New South Wales, is not counted; nor the Europeans in that neighborhood, and at Delegete, where the boundary is supposed to cross.

"Since I had the honor of furnishing a report on the Boggy Creek goldfield, dated 14th August, 1867, I have several times visited that locality, and it has appeared to me to possess features which may be of interest as possibly throwing some light on the gold drifts which may be found under similar circumstances near the coast.

"Boggy Creek, otherwise called Prospect Creek, rises about twenty-five miles north and west of this place, at the termination of spurs from the Great Dividing Range, which extends southward, parting the waters of the Wentworth and the Mitchell from those of the Nicholson River. The hills at its source are composed of silurian formations, in which most of the Gippsland goldfields are situated; they are probably about 1,500 feet above the sea; and, as is very often the case in this district, end somewhat abruptly at the low country bordering the coast-line. In this instance Boggy Creek flows through them for about six miles, receiving the drainage of several tributaries, such as the Right-hand Branch and the Two-mile Creek, and of numbers of long flat gullies, all of which rise in the same formation. At the termination of these hills the creek crosses an extensive area occupied by porphyry,* which forms on the eastern side an elevated flat-topped hill known as Mount Taylor, and on the western side another hill called Mount Alfred, both of which may probably be 1,200 feet above the sea. From this point, for some six miles, the creek has cut a deep bed through the porphyry, until it reaches a spot where a creek (the Mi-Mi) joins it from the southern end of Mount Taylor, and from a third mount named Mount Look-out, where the porphyry as abruptly disappears from the surface as it has appeared in the first instance. Here the valley at once widens, and the course of the stream is through considerable flats composed of beds of gravel and sandy loam. Further down, the character of the valley changes to the fertile black soil of the Mitchell River valley.

"In looking at a section, it is seen that the silurian rocks forming the bed of the upper part of the creek in many places appear at the surface, while lower down they are gradually covered with deposits of gravel, clay, and sandy loam, which increase in depth (the channel of the stream being very tortuous and the current sluggish) until at the point where the porphyry appears, and here the strata are covered by from twenty to twenty-five feet of deposit, extending across the valleys both of Boggy Creek and of the Five-mile Creek, which here joins from the east. The alluvium at this place is mainly composed of fine sand deposited in beds of varying thickness and of a yellowish color, derived from the silurian rocks. Layers of clay and of coarse quartz grit are

* Granite on the sketch map.

also visible, probably derived from the washings of the flanks of Mount Taylor and Mount Alfred. Near Mount Taylor the porphyry appears, showing in the hills flanking the creek, in a south-east and north-west line, and in the creek itself it is seen in Jones and Labudda's claim, forming a high rise in the bed, at first about four feet, but gradually rising down the course of the creek until it appears at the surface, where the stream has cut through it to a depth, in some places, of sixty or seventy feet, leaving precipitous masses of porphyry standing on each side, which are rudely columnar in structure.

"I have been unfortunately unable to see the exact contact of the porphyry with the silurian rocks in Jones and Labudda's claim, the spot having been covered with headings during the work; but in one section the strata are seen about twenty feet from that place, and I am informed that the porphyry appeared as a hard bed, sloping underneath and against the course of the creek, with a drop of about four feet where the slates and sandstones suddenly appeared, and that these rocks were tilted up at somewhat a higher angle than where I saw them. At this latter point I found the sandstones dipping about 10° to the N.E., with a S.E. and N.W. strike, and alternating with soft blue slates, in all respects similar to the bed-rocks seen higher up the creek; and it is worthy of note that these rocks do not appear to have undergone any alteration from the adjoining porphyry.

"As I have before stated, the porphyry appears in precipitous cliffs along the creek, being the faces of long spurs from the mounts flanking the creek, and which have evidently been worn down by the action of water finding a level, and, possibly at an earlier period, by sea currents or by waves beating on a coast-line.

"The cutting thus formed has partially drained the upper part of the area, and in doing this has caused the deep and tortuous bed I have spoken of. It will be further seen that the sand, clay, and gravel beds continue across the porphyry, where they thin out; and at a little above this point the traces of a peculiar quartz and crystalline sandstone drift appear in the spurs above the creek, and gradually increase and rise in elevation from the creek until they join the extensive deposits of sand and white quartz which extend round Mount Look-out and Mount Taylor, and which are, I believe, the thinning out of later tertiary formations covering so much of the low country adjoining the Gippsland Lakes and the sea-coast.

"I must also point out that near Mount Taylor the gravel beds and creek drift entirely change their character, being no longer composed of the *detritus* of the silurian rocks of the upper creek, but consist, so far as I could ascertain, of rounded boulders and gravel of porphyry, and of a highly crystalline quartzite, and of quartz conglomerate. This crystalline quartzite appears, in numerous instances, to pass insensibly into the conglomerate, and is probably but the finer beds of the same.

"The porphyry crosses the course of the creek at the junction of the Mi-Mi Creek, where it forms the rocky bed of the stream, but owing to the ground suddenly becoming deep on the lower side of the porphyry, and to the adjoining hills being low and covered with soil and drift, I have been unable to obtain the general course of that formation.

"No silurian rocks appear anywhere below this point, and no stratified rocks except the conglomerate I have mentioned, and which I shall have occasion to refer to later. From this point the gold is found in a loose drift, sometimes on a cemented bed of red colored fine gravel forming the creek banks and bed; again, as in McDiarmid's claim, in a stratum of loose gravel resting on a lower stratum of the same, which probably overlies the bed-rock of decomposed porphyry. This seems to

extend throughout the lower part of the creek, and also may underlie at an increasing depth the tertiary beds down to the Mitchell River. From these facts as regards the position of the auriferous drifts lying in false bottoms which continually thin out in the course of the creek, descending as it were to lower levels until the bed-rock is reached, it would seem, first, that they have been deposited at various times by floods descending the valley of Boggy Creek, and secondly, that auriferous deposits may be looked for below the false bottoms I have mentioned.

"From and below the base of Mount Look-out, the sinking varies from three to twelve feet.

"Not only does the character of the drift alter near Mount Taylor, but the gold alters likewise. In one locality it is nuggety and water-worn, while below it is finer, more flaky, and, although rounded, apparently more spongy in character. From this it seems highly probable that the gold has been derived from the decomposition of the porphyritic hills, but I have not yet been able to devote the necessary time to this interesting question.

"I have stated that the character of the drift changes, and on regarding the hills flanking the stream the remains of beds are discovered from which the quartzites have been derived, while below McDiarmid's claim a stratum of conglomerate, composed of large rounded pebbles and boulders of white quartz embedded in a silicious base, seems to remain *in situ*; and it is probably the lowermost bed, as it rests on the same decomposed porphyry spoken of above. It seems most likely, from the appearance of the ground, that at one time the course of the stream may have been at the back of the conglomerate ridge, and indicated by a watercourse which intersects the large flat found there; this, however, could scarcely have been the case, unless the coast-line had been submerged again after its elevation, when the supposed channel would have been formed.

"I could only show the mode in which the quartzite beds overlie Mount Look-out by sections.

"The beds are finer in structure in the higher parts, and become more like the conglomerate as they descend. In some places these beds may be seen overlying the same mass of porphyry which appears at Mount Taylor and elsewhere. They are, however, so completely fractured that I could nowhere discover any portions from which their dip and strike could be ascertained. I have no doubt, however, from their general appearance, that they overlie the porphyry and conform to its general outline as such fractured and upheaved beds might do.

"Following round the southern flanks of Mount Look-out, which here descend steeply into the low country, the tertiary sand and drift appear in a thin capping on the quartzite beds; and although this drift is evidently due to marine action, as may now be seen on the Ninety-mile Beach, yet the higher parts of Mount Look-out, although thickly covered with angular fragments of quartzite of all sizes, do not anywhere, as far as I am aware, show rolled gravel or boulders above the drift line, excepting at one place—a saddle between Mount Look-out and Mount Taylor—where the road to Boggy Creek crosses, and where, judging by the eye, the line of drift is higher than elsewhere.

"Near a creek—rising on the eastern side of Mount Taylor, but which in reality is scarcely more than a gully—the porphyry descends suddenly in wide, smooth faces, forming one side of the gully, while the opposite side is occupied by a ridge of silurian rocks, but so covered by soil and loose stones that, without excavating, it would be impossible to judge of their condition. The bed of the gully is choked with masses of

rock derived from both formations. It seems not unlikely that this gully may have been partly excavated by the sea, and the high faces of rock worn down by the same agency.

"The same tertiary drift surrounds this side of the two mounts; and here, also, forming a steep descent into the basin of what is now Clifton's Morass, but which no doubt was, in tertiary times, an estuary, if not a sea bay. From the north end of Mount Taylor a narrow ridge of silurian rocks extends to the area occupied by that formation. Here again the contact of the porphyry and slates can be pointed out to a few yards, but the actual point of junction is hidden under a great accumulation of angular fragments of all sizes. Mount Taylor and Mount Look-out were, no doubt, at one time a promontory, as indicated by the line of drift surrounding them, and extending for some distance up Boggy Creek itself; and the auriferous drifts may, under those conditions, be the result of both fluvial and marine action. I think that the variable false bottoms would thus be accounted for. In the valley of the Mitchell River limestone beds are to be found, and it is to be hoped that the gold workings of Boggy Creek may, in time, be so far extended in that direction as to permit of the connection between the auriferous drifts and these limestones (which are rich in fossils) being determined. * * * * *

"I have nowhere seen indications of dykes or of veins sent by the porphyry into the stratified rocks, although, from the scrubby nature of the country, and the great accumulation of soil, such may exist; but if such dykes or veins are present, rolled fragments ought to be found in the creek gravels.

"The outlying patches of drift—to all appearance identical with the tertiary marine deposit, now spread over a large area in this district—also, to my mind, indicate a gradual upheaval, when the beds, which were at one time continuous round the mountain, would be denuded by the floods passing down the valley of Boggy Creek, and would be re-deposited as a delta on the flat country; and, under these circumstances, the auriferous alluviums carried from the upper part of the creek and from the flanks of the mount would be mixed with marine deposits, and re-arranged, as seems to me to be the case on Lower Boggy Creek.

"The present insignificant volume of this stream seems, however, somewhat inadequate, excepting during the course of immense periods, to account for the great denudation that has gone on, as well as the cutting through of the solid porphyry to a great depth.

"But if, as I suspect, much of this denuding action has gone on during the later tertiary and prior to the recent period, it must not be lost sight of that the physical geography of Australia was at that time materially different to the present, in so much that the greater part of Central Australia, as well as the Riverine District, would then have been submerged, and not as at present a depressed, heated country of sand and stones. I conceive that, at that time, instead of a hot, dry wind blowing from the northward during a great part of the year, the wind from that quarter would have been comparatively cool and bearing moisture from the ocean and from the tertiary inland sea which then existed; and that the rainfall on the northern slopes of the Australian Alps may have been as great as that now falling annually on the most rainy parts of the south side; and that, probably, the climate may have resembled that of portions of New Zealand.

"Such being the case, it follows that the volume of the rivers in these mountains would be immensely augmented, and that we can thereby account more easily for the evidences of great denudation and erosion than by assuming the present rainfall as our

standard; and it will apply, I think, more clearly to the results seen in the neighborhood of an insignificant stream, such as Boggy Creek, than to the Upper Mitchell, the Mitta-Mitta, or the Snowy River, whose currents are even now very rapid." * * *

This country, having a fine climate, gold workings both in the veins and in the alluviums, abundance of timber, good soils, and plenty of water, will, in due time, attract the capitalist as well as the working miner and the farmer.

Gippsland includes within its area much that is attractive to the Victorian colonist. Its climate, in consequence partly of its principal river basins running nearly at right angles to the coast-line, and partly because of the great altitude of all the land lying to the north and north-west—whence come the dry and hot winds—is cool and agreeable. Its soils, derived from porphyries and limestones, as well as palæozoic rocks and granites, are sufficiently rich. It is well timbered and well watered; and all its swamps and low-lying lands could easily, by the exercise of a little skill, be turned into luxuriant meadows. It has many lakes and navigable streams, and not a few ports which any moderately competent engineer could make safe in all seasons. It is rich in gold. Both veins and alluviums are rich; and though, up to the present time, deep leads have not been developed, it is almost certain that the older drifts will be found and wrought.

It is known to yield coal, copper, tin, bismuth, and other metals and minerals of economic value.

The scenery, of many diverse kinds, is exceedingly fine; and when wealth, which brings leisure, and education, which enforces taste, shall have been acquired by the younger colonists, they will seek health and retirement in the mountains of Gippsland.

This slight and very imperfect sketch of the shallow alluviums, as they are observed to occur throughout the colony, is perhaps sufficient to show what a vast amount of wealth lies yet buried in the soil. As already stated, the alluviums are not only valuable because of what they yield so abundantly and so easily, but because they indicate with clearness the character of the rocks from whence the *débris* and *detritus* composing them have been derived. The veins intersecting the bed-rocks where the shallow drifts are lying are the depositories of the gold; and these veins are so rich, and so extensively distributed, that we would have no reason to despair of the future of the colony, even if all the shallow drifts were already exhausted. But they are not exhausted. Thousands of square miles of untouched country are yet in reserve.

This confessedly feeble attempt to convey some useful information respecting the shallow workings—which in the early days of the colony attracted thousands of persons to Victoria, from all parts of the world—will, I venture to hope, assume, at some future time, more the appearance of a close and connected narrative, and will be illustrated by facts which will be more valuable to the geologist and the miner than any collected in this paper.



Sluicing and Hydraulic Mining.



In all the mining districts there is a large number of men engaged in sluicing, and they have cut races or ditches for conveying water to their claims of an aggregate length of 2,300 miles 24 chains at a cost of £321,903.

It is not every goldfield, however, that is favorably situated for this kind of mining. It has had the greatest development in the Beechworth District, and Mr. Peter Wright, Assistant Engineer for Water Supply, who has had much experience in mining, both in California and Australia, has placed at my disposal the following notes and sketches:—

He says:—"When gold mining was commenced in the Ovens District in 1852, the possession of a cradle denoted a well equipped party, and thousands of ounces were separated from the washdirt by means of the pan alone; however, from the position of the district (on the road from Sydney to Victoria), large numbers of Californians were led to it, and through them improved appliances were early introduced. While the claims allowed were small, the progress made was trifling, only a few of the most enterprising venturing upon long-toms, into which the necessary water was raised with buckets; but as the inconvenience of the regulation claim was soon felt, local public opinion soon sanctioned the occupation of claims suitable to the locality, and the holders of these, feeling assured of continuous employment for considerable periods, began to adopt improved methods of working, and the best appliances known to them. Here the Californian experience of many was of great service to all.

"The new appliances for separating the gold from the washdirt were two in number, viz., the tom and sluice, in both of which the gold is separated from the surrounding earth by taking advantage of its greater specific gravity.

"The tom was the first introduced. It could be used with a small head of water, and was therefore more suitable at a time when water races were not, and the necessary water had to be baled. It is composed of two inclined troughs or boxes, placed one over the other; the upper box or tom proper has a grating in the bottom near the lower end, and under this grating is placed the lower or ripple-box. A stream of water being caused to flow through the tom, the earth is thrown in and is washed by a workman with a square-mouthed shovel; the sand, earth, and small stones are carried through the grating by the water and fall into the ripple-box, while the larger stones which remain on the grating are removed by the workman. The ripple-box is set so far from the tom and with such an inclination that the water used will leave the bottom covered with a thin layer of loose material; the particles of gold or other heavy minerals thus easily reach the bottom, and with proper management will remain there; but lest any stray particles should escape, there are usually several

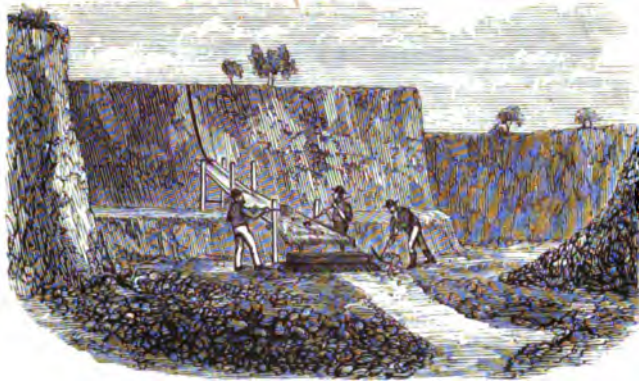
bars or ripples (hence the name) placed across the lower part of the box, over which the water flows, carrying with it the lighter materials.

"The long-tom was the first used. It is or rather was a box of twelve or fourteen feet in length, with a uniform width of about eighteen inches. The width being uniform, was too much at the upper, and too little at the lower end, and the inclination being also uniform, it was excessive at the lower end, or insufficient at the upper one. The Victoria, Jenny Lind, or broad tom, was therefore introduced to avoid these defects. It is short, usually about six or seven feet in length, about twelve inches wide at the upper end, and three feet at the other; and a box or a series of boxes fitting into each other convey the water and washdirt into the tom.

"Requiring a moderate head of water, and capable of dealing with earth of a considerable degree of adhesiveness, this tom was extensively used for many years, and is not altogether laid aside now.

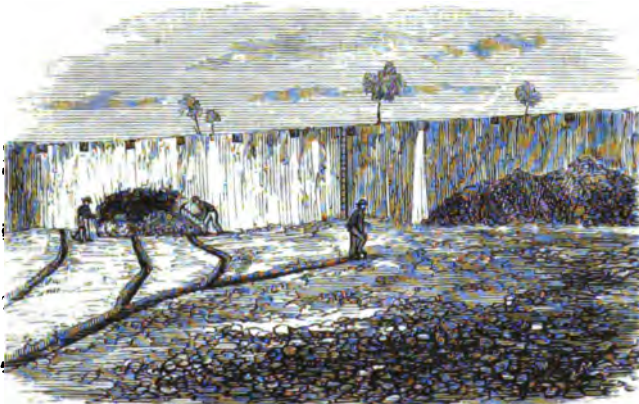
"The sluice followed the tom closely in time, and soon took the lead of it in use. It requires more water than the tom, but with that it will wash the earth with less manual labor. A sluice, however modified, consists essentially of an inclined channel, through which a stream of water flows, and the earth being conveyed into this channel, the water breaks it up, carrying the lighter materials away, and leaving the gold, tin ore, &c., behind. They are commonly classified into—1st, box, and 2nd, ground sluices. These classes may be defined—the first as sluices raised above the bottom, into which the earth must be elevated by manual or mechanical power; the second as sluices sunk in the bottom, into which the earth is conveyed by a stream of water.

FIG. 14.



TOMMING.

FIG. 15.



COMMON GROUND SLUICING.

"The box-slucices are portable, and consist of a series of inclined troughs (known as boxes) set on suitable trestles. The boxes are made of sawn boards, and are somewhat narrower at one end than at the other, so that the lower end of one may fit into the upper end of the next, and thus form a continuous channel. They are usually in twelve feet lengths; the width and depth being varied to suit the work, or perhaps merely to suit the fancy of the owners, and the inclination also varies considerably, ranging from one in fifty to one in ten, usually having an inverse ratio to the quantity of water available.

"The ground-slucices are always fixtures; in many cases they are merely channels cut in the bottom or bed-rock; but they are often substantially built of sawn planks. Whether boarded or not, they are expensive, the cost ranging from £100 to £8,000.

FIG. 16.



BOX SLUICING.

"As the character of the workings governs the method of sluicing, a few words about them will make the subject clearer. They may be separated into two classes: first, those in which the bottom is below or about the level of the adjacent creek, and, secondly, those in which the bottom is sufficiently high to afford the fall necessary to a sluice. This will nearly correspond with the usual division into creek and hill claims, and will suit the classification of sluices—as the portable box-sluice is commonly used for No. 1, and the ground-sluice for No. 2. The method of working the first class is varied to suit local circumstances—those affecting the sluicing being the quantity and quality of the washdirt, the nature and depth of the overlying strata, and the facilities for drainage. The non-auriferous earth above the washdirt varies in thickness from a few inches up to two hundred feet. When under ten feet it is always thrown back, and the washdirt exposed in the open cutting thus made; when between ten and thirty feet in thickness its nature will determine whether the washdirt should be laid bare or whether it should be mined; and when the depth exceeds thirty feet the washdirt is always mined.

"There is not much difference in the sluice in either case. A sluice used on the surface, when the ground is mined, does not require to be moved often, and is usually more substantial than one used in an open cutting, which may require to be moved every day it is used, and, as when the washdirt is mined, it comes to the surface in

considerable quantities at a time, the upper box, into which it is emptied, must be made of a suitable size.

"When the washdirt is bared in an open cutting the sluice is set up over it, and, the necessary water being conveyed to it through a flexible hose, the earth is shovelled directly into the boxes. As already said, the inclination given to the sluice has, usually, an inverse ratio to the quantity of water available—this in its turn is regulated by the facilities for drainage. Where a drain can be provided, so as to allow the tailwater to flow away, a large quantity of water may be used with flat boxes; but where the tailwater has to be raised by mechanical means, the want of sufficient power commonly causes a small head of water to be used, and, in order to get a reasonable quantity of earth through the sluice, a considerable inclination must be given to it.

"Where the inclination is about one in forty or fifty there is no trouble in saving the gold, but where, as is common, it is from one in twenty to one in ten the plain box is not sufficient, and further contrivances are used. When stones are plentiful in the washdirt a small bar is placed across the lower end of each box, which prevents the bottom from being run bare—a workman, with a steel fork nearly as wide as the boxes, throws out the superfluous stones, and occasionally loosens the materials which the bars have detained.

"False bottoms are often used, which, for this mode of sluicing, usually consist of boards fitting inside the boxes, and bored with as many inch or inch and a half holes as the wood will allow of. Where the washdirt is fine these are used by themselves, but where it is coarse a forker must be placed at the upper box to throw the stones out.

"The number of boxes in a sluice varies, ranging from two to five. Where the earth is perfectly free one box is sufficient, though seldom used, but if at all adhesive it will require at least three boxes for its reduction. In some cases the earth is too adhesive to be properly dealt with in the short sluice available in open cuttings—the tom is then adopted, it having the power of dealing in small room with earth of a considerable degree of adhesiveness.

"Ground-sluicing is the common method of working elevated ground, but it is not exclusively used, neither is it confined to high ground, being occasionally available in creek workings. Its two essentials are an ample supply of water and a clear outfall for the materials passed through the sluice. The first is not always to be had on the workings, either high or low; the second, though usually available for high ground, is seldom so for creek workings. In the higher parts of the district, near Beechworth and Stanley, water has always been comparatively scarce, and the 'regulation' sluice-head small. The ground being good there was a ready market for water, at a high price, and it was used as often as possible—the tailwater of the upper sluice being used for a second at a somewhat lower level, and so on for as many as six and eight times, with about twelve feet top of fall for each sluice.

"A ground-sluice will require at least twice the quantity of water allowed there, and will involve a top of at least thirty feet of fall, more probably of fifty feet, taking quantity and fall together. A ground-sluice would therefore require at least as much water as six box-sluices; and, comparing the cost of water with that of manual labor, it was for many years advisable to use the latter; but, as the richer ground got exhausted, water became of less value, so that in time it was found advantageous to hire more water and fewer men; and the ground-sluice has become the fashion in the upper as it always has been in the lower parts of the district, where water is more plentiful.

"The chief obstacle to the use of the ground-sluiice for creek workings is the difficulty of getting a clear outfall. This has been overcome in a number of cases, but at a very serious expense. The Excelsior Sluice, on Reid's Creek, cost £5,000 before it gave any return, and has since cost over £3,000 additional for extension. The Rocky Mountain Flume, on Spring Creek, cost £2,000 before it paid anything, and has since cost £6,000 for extension, and it is now about to be deepened, at an estimated expense of £2,000. These are the largest; but the cost of many others has been considerable, ranging from £1,000 to £4,000.

"From the generally open texture of the earth in the creek flats, these sluices are capable of passing large quantities. No actual measurements have come to my knowledge, but it is estimated that some of them will wash away 400 cubic yards in twenty-four hours, when working with a full head of water.

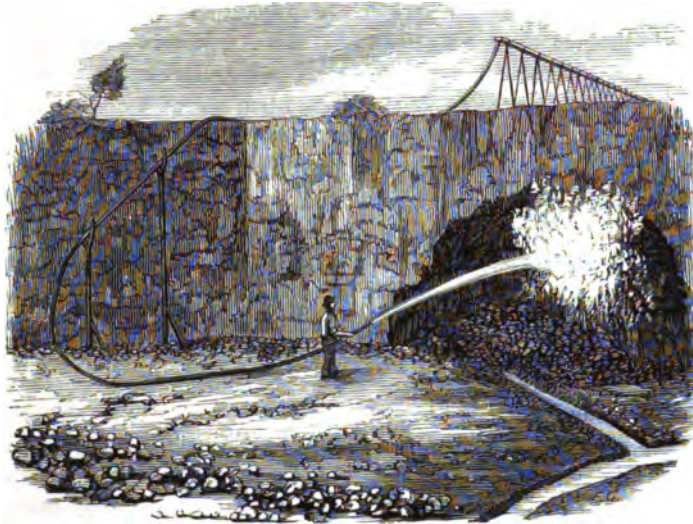
"From their position these creek ground-sluiices can usually command large heads of water, they are therefore built very flat, the inclination ranging from one in one hundred to one in seventy. The bare sluice is, with such inclinations, sufficient to save the gold, but it is necessary to protect the wooden bottom from the wearing action of the stones, &c., passing through the sluice. Some are paved with large stones; others are paved with blocks of wood, grain on end; and others have false bottoms, which, for this sort of sluice, are commonly stout battens framed together and lying lengthwise in the sluice. The paving is useful in cases where clay has to be dealt with, and the false bottoms have the advantage where the fall is scarce, as they offer fewer obstacles to the free passage of the water, &c. Either plan answers for saving the gold.

"As the free outfall is always available on the hills, the chief trouble is with the water supply. In some places water cannot be had at all, and generally it is necessary to construct long races to lead it to the place where it is required, and few hill races are under four miles in length, and several are about twenty, and one is nearly forty. The water being led to the required spot, a channel is cut in the line of the proposed sluice, the water turned into it, and workmen standing in the channel pick up the bottom (the water carrying the earth away) until the desired depth is reached—usually in the bed-rock. The sluice in this state is as good for saving gold as it can be made, but as the bottom, whether rock or earth, is often too soft to bear the necessary abrasion, and wears irregularly, it is now a common practice in such cases to board the sluice before beginning to work the auriferous ground. When the sluice is ready, the earth to be washed is got or broken out of the solid, pretty much in the same way as in a railway excavation, but instead of being shovelled into carriages for transport, a stream of water is turned over it which carries it into and down the sluice. In the hydraulic system the earth is got by means of a jet of water brought to bear on the face of the cutting by means of a flexible hose with a nozzle like a fireman's branch. Where the ground is shallow and compact there is little, if any, advantage in the use of the jet, but where the ground is loose or deep it is of great service, being safe as well as economical. When the face of a cutting exceeds twenty feet in depth, it has to be carefully watched when men are under-cutting it, and when it exceeds thirty feet in depth it is unsafe with any watching. On the other hand, I have seen cuttings nearly sixty feet in depth safely wrought with the jet, the workman directing the water being able to stand at a safe distance from the face.

"The manner of getting the earth does not affect the sluice, the method of washing being the same in both the hydraulic and common systems.

"The quantity of earth which can be dealt with by a ground-sluiice varies considerably, the quantity of water available, the inclination of the sluice, and the nature of the earth, all affecting the result. With gravelly loam 150 cubic yards in a short winter day is not uncommon, though much above the average, which will scarcely reach half that quantity. At first, sluices were kept running night and day, but reservoirs are now everywhere used to store the night water so that it may be used in the day-time. The number of men employed about a sluice varies from one to five or six, two and three being most common. The quantity of earth washed per man varies from twenty to fifty cubic yards with the common sluice, and from 50 to over 100 yards with the hydraulic sluice.

FIG. 17.



HYDRAULIC GROUND SLUICING.

"In most cases gold is the only metal sought for, and in the claims where tin ore is also sought for there is no difference in the method of working, as the appliances used are equally suited for either the metal or mineral, or both.

"The alluvium in the creek flats is pretty nearly the same everywhere; the washdirt is a gravel, usually open, occasionally slightly adhesive, and the overlying strata vary often, but within narrow limits. On the slate bed-rock, a gravelly drift with layers of silty clay is most common, and on the granite bottom the drift becomes finer; there is little other difference. When the clay lies on or near the washdirt, as it sometimes does, it makes a middling roof for driving under. The washdirt varies in thickness from a few inches up to six feet. On the slate rock gold alone is sought for, but on the granite bottom tin ore is also found. It is interspersed through the washdirt pretty much as the gold is. On Yackandandah the ore is so poor as not to be marketable; it is therefore considered to be a serious nuisance, giving, as it does, much trouble. The ore exported from the Ovens is found exclusively on the Woolshed Creek and its tributaries. On the Woolshed and Reid's Creek it is secondary to the gold, but on some of the tributaries the ore found is worth more than the gold. No vein of the ore has yet been discovered, but I am not aware of any earnest search having been made for one.

"On the hills the strata vary very much, ranging in depth from a few inches to sixty feet, and in compactness from a loose gravel to strong clay. The depth, whether great or small, is not an obstacle to sluicing, so long as the bottom is high enough, but the texture sometimes interferes, the earth being occasionally too adhesive, and, if wrought at all, it is by means of a puddling mill. This, however, is rare."

As supplementary to his notes on sluicing, Mr. Wright has furnished some memorandums on the yield of gold by sluicing operations; on the character of gold found on granite and slate bottoms; on the distances which free gold may be carried by water; on the character of drift and rock bottoms under waterfalls; and on the physical configuration of rivers and affluents in the district which he is so well acquainted with; and they are here given in his own words. Every practical man will recognise the value of them, based, as they are, on personal experience. It is right to say that they were drawn up in reply to questions, and they are not in such a form as he would have put them if he had had time and opportunity to elaborate them:—

"It is not possible to state what the yield will be by any style of operation, as that will mainly depend upon the richness of the earth operated upon.

"Neither is it easy to say what quantity of earth can be sluiced in a given time, as no two sluices are at work under exactly similar conditions.

"Where the earth has to be lifted into the sluice, the quantity will be regulated by the capability of the men. With four men employed one will be filling constantly, and as the lift will be four and a-half or five feet, twenty-four cubic yards will be a good day's work—thus giving six cubic yards per man.

"With free earth the tom may do as much, but it cannot do more, as the men cannot lift more. Where the earth is washed into the sluice, the quantity dealt with will depend upon a number of circumstances, such as the quantity of water used, the inclination of the sluice, the quality of the earth, the skill of the sluicer, &c. The best results I know of were obtained on a hill overlooking Allan's Flat, Yackandandah. The ground sluiced was about thirty feet in depth, chiefly a quartzose gravel, the quantity of water used would be not less than 500 gallons per minute, and the inclination of the sluice about one in twenty-five. Three men were usually employed, and the ordinary day's work was about 150 cubic yards, being fifty yards per man. My own operations in hill-sluicing would average about twenty-five cubic yards per man per day.

"In hydraulic or jet sluicing the results vary very widely, ranging from thirty cubic yards per man to as much as 200 yards per man. Jets are worked with thirty feet of head, and with seventy feet, or even more; and the earth sluiced varies in depth from ten feet in some claims to sixty feet in others, and it is sometimes chiefly gravel, and sometimes principally light loam. It is therefore extremely difficult to fix upon an average.

"The current wages of hired men are at present from 7s. 6d. to 8s. per day. Water is sold from the State reservoirs at '33d. per thousand gallons, and other expenses, such as tear and wear of tools and appliances, are not heavy.

"The daily expenses of a claim may be put thus:—

Three men at 8s.	-	-	-	-	-	-	-	£1	4	0
360,000 gallons of water, at '33d.	-	-	-	-	-	-	-	0	10	0
Tear and wear	-	-	-	-	-	-	-	0	6	0
								£2	0	0

Equal to about half an ounce; so that with work like that on Allan's Flat, a yield of four-fifths of a grain per cubic yard would cover expenses.

"There is a marked distinction between the gold found on granite and that found upon slate. Both vary in size of particles, but whether coarse or fine, they preserve their general character, the particles of granite gold being flat spangles, while those of the slate gold are compact and cubical in shape.

"I have no theory as to the cause of the difference, but I am inclined to think that diverse origin had much to do with it. The cause commonly assigned is attrition, but I do not understand how attrition should abrade gold diversely in different localities.

"I am not justified in stating positively that there is an abrupt transition in the character of the gold at the edge of the sedimentary strata. It was so on Yackandandah when the ground was first worked; it is not so now. At the first time of working the loose upper drift was thrown back, and a stratum of compact gravel lying on the rock was all that was sluiced; there was then no spangle gold found until the granite was reached. The drift previously thrown back is now being sluiced, and spangle gold is now obtained at some distance from the granite, but how far I cannot yet say.

"Judging from my experience in sluicing, I do not think that free gold could be carried far by any natural force now operating in the country. Combined mechanically with other substances it might be otherwise, but I cannot speak of that, as my experience has been with free gold only. My sluicing operations have all been on granite country, the gold of which is always in the form of spangles, many of them so thin and light that when dry they will float upon water. If my experience goes to show that this gold is with difficulty moved by water, what can be said of gold of which the particles have a compact cubical shape?

"On one claim I raised the auriferous gravel to a box-sluice on the surface. The sluice was twelve inches wide, and was placed at an inclination of one in forty-eight, and the quantity of water used was about 600 gallons per minute. The sluice was usually paved with large stones, but in washing down these had to be taken out. I have often washed down with the full head of water, and found ninety-five per cent of the gold within three feet of where the gravel was filled into the sluice—where the gold was lying upon a smooth board, and yet a powerful current failed to move it. It may be said that, lying flat and presenting the edge to the current, no hold was given; but gold thrown down promiscuously could hardly have the edges of all its particles presented to the current. I knew of two cases in which heaps of washdirt were carried away by floods, but as well as could be known there was no loss of gold. About as much was gathered from the ground on which the heaps lay as the dirt was expected to yield.

"In some of the large permanent sluices stone paving is used as a false bottom, and nothing under twenty pounds would be secure. I have seen stones of greater weight displaced by the power of the water.

"I do not say that free gold cannot be transported by water; but I do think that the streams we know have not transported the gold lying in their channels to any appreciable distance. The manner in which the gold is spread confirms me in this opinion; it is spread pretty evenly over flats from 100 to 450 yards in width, and with so little fall that people do not attempt to cut water races from them, as the fall in the creek is little if anything more than is required for races. The Yackandandah races head almost universally from the cañons between the flats.

"Thinking as I do, I necessarily come into conflict with opinions of others; for if the gold lying on the granite has not been transported from existing sedimentary

quartz-bearing rocks, it is either the result of the denudation of sedimentary strata formerly overlying the granite, or, having no connection with sedimentary rocks, it may be the result of erosion in the granite, which is decomposed to an unknown depth, or, as I am more inclined to suspect, the result of chemical action still in operation.

"The first hypothesis is apparently more consonant with existing opinion than the others, yet if it be adopted we must concede that the formation of auriferous quartz veins was anterior to the elevation of the country, for the ocean has been the chief (I might almost say the only) agent in the enormous erosion which has taken place in this district.

"Take for instance the valley in which I am now working: it is partly drained by Kinchington's Creek, partly by Barwidgee Creek, the first flowing ultimately to the Kiewa River, the second into the Ovens River; the low ridge between thus forming the watershed of the two rivers. Neither of the creeks named are capable of much in the way of erosion, and on the ridge between them they could do nothing, yet this ridge has been denuded of the sedimentary strata which the neighboring mountains are composed of. I cannot state the thickness of the denuded strata, but the Stanley Range rises very abruptly for about 1,000 feet; Big Ben is higher, and Dedarang is higher still; the two latter being parted by another deeply eroded valley. As the tops of these mountains are very little lower than the Main Divide, it is obvious that no river could have cut out this valley. This instance is decisive in itself, but apart from it the whole country bears the impress of the same oceanic agency.

"If then we hold that the gold upon the granite is the result of the denudation of silurian strata formerly overlying the granite, I think that we must come to the conclusion that some auriferous quartz veins are of great antiquity, a conclusion which clashes somewhat with the theory (recently put forward) of the barrenness of all but the more modern veins.

"I know of several deep pools under water-falls which have been emptied, with the expectation of finding rich gold deposits, and in every case the result has been the same—a mere color of gold being found.

"The first tried was a large pool lying under the falls between Reid's Creek and the Woolshed. In this case there was no earth to deal with, the water being sufficiently powerful to keep the pool clear. The depth of water was about fifteen feet, and the height of the falls about thirty feet (I speak from memory).

"The next I know was a hollow under the main falls on Reid's Creek, and it was filled with drift, the water having latterly been unable to keep it clear.

"The Twist's fall, on Yackandandah, was somewhat similar, a pool having existed at one time, though not in human memory. In all three cases a little gold was got, but as I have already said, only the color.

"There are numerous rapids on Yackandandah, and these have commonly deep hollows at the lower end, pretty much like those under falls, and in no case has more than the color of gold been got in them. At the head of Osborne's Flat a depression at the mouth of the cañon was tried, at considerable cost, and only the color got, yet the shallow ground immediately below was very rich: the same circumstances occurred at the head of Rowdy Flat.

"All large auriferous rivers show analogous cases; in them gold is always found on the bars or points, and not in the deep pools or bends.

"From hearsay I know that in California the same law prevailed. I cannot at present name more than one-place, namely, Wood's Creek, near Sonora, on which there is a fall with a deep hole below it, which was tested, and the results were *nil*.

"I have heard of other places, but cannot at present name them; I will, however, enquire further for my own satisfaction, as I wish to be able to give authorities for my opinions.

"Suggested by the above topic, although not really connected with it, is the non-deposition of gold in hollows lying much below the general level of the rock bottom on which the auriferous drift rests. Such hollows are frequent, and I am not personally aware of any case in which the auriferous drift filled them; indeed, so far as I know, it in all cases extended across the hollow at about the general level of the bottom, the hollow beneath being filled with drift of another description, usually lighter and more open. The auriferous drift is usually a compact gravel, and that filling the hollows is usually loose sand.

"As far as I know, either personally or from hearsay, the large streams in the north-eastern parts of Victoria and adjacent part of New South Wales have similar characteristics, which are peculiar to the country. The rivers are not affected by the general level of the country, but flow with a moderate fall in very mountainous regions. From the border of the hill country one may travel for fifty miles on what may be termed a level road, while the land on either side has risen over 3,000 feet; but there is an end to this. Sooner or later one comes to the head of the valley, and further progress must be made by rising at angles of from thirty to forty-five degrees. The nature of the rock does not seem to influence the gradient of the river beds, though it makes much difference in the steepness of the adjacent ranges, the silurian rocks having easier slopes than the metamorphic.

"One consequence of the flatness of the river beds is that the affluents are generally torrents; on slate rocks the fall is usually evenly distributed, but on granite it is divided into steps, the general slope being easy, and the excess taking the form of falls or rapids.

"From hearsay I know the rivers of California to be generally different, as they partake in a considerable degree of the general inclination of the country. The Sacramento and the San Joachin, flowing parallel to the Sierra Nevada, have easy grades; but others, flowing from the Sierra, have excessive fall for streams of such magnitude, compared at any rate with the rivers of this country."

The hydraulic works of Messrs. Stewart and Farnsworth, near Talbot, are extensive, and are worthy of attention, as showing how far energy and skill can change the character of a country, turning a dry and arid tract into a scene of bustling activity, where water is the power on which the laborer shall depend for employment and profit.

Mr. Joseph Smith, the Mining Surveyor at Talbot, gives the following description of the works:—"The reservoir of Messrs. Stewart and Farnsworth was commenced on Stony Creek in 1858, and intercepts McCallum's Creek by a head-race. The reservoir has been enlarged year by year, so that it now covers nearly 40 acres when full; the greatest depth being 32 feet. The cost of the reservoir and catch drains was about £7,000, and the distributing drains about £3,000. Two sets of hydraulic apparatus are supplied during the winter months, which expend about 864,000 gallons of water per diem, by working twelve hours, viz., four sluice-heads for Kangaroo Gully, and two sluice-heads for Pinchgut Gully; one sluice-head being equal to 200 gallons per minute.

"The summer distribution is about ten sluice-heads to the various goldfields in the locality, and two sluice-heads for irrigation and domestic purposes, in the following manner, viz.:—

Ballaarat Hill	-	-	-	-	-	-	2 boxes
Grub Gully	-	-	-	-	-	-	2 "
Riley's Gully	-	-	-	-	-	-	1 "
Nuggety Gully	-	-	-	-	-	-	1 "
Scandinavian Lead	-	-	-	-	-	-	1 "
Hard Hill	-	-	-	-	-	-	1 "
Red Hill	-	-	-	-	-	-	1 "
Kangaroo Gully	-	-	-	-	-	-	1 "
Irrigation and domestic	-	-	-	-	-	-	2 "

Total - - - - - 12 X 144,000
= 1,728,000 galls. daily

"This is estimated at twelve hours per diem; but the reservoir is not large enough to supply the foregoing quantity during the whole of the summer months. The reservoir became dry in December, 1865. At the present time (4th February, 1867) it has only about 10 feet of water with a reduced area, which will be expended in less than a fortnight, at the present rate of consumption.

"Profitable employment could be found on the goldfields in this locality for more than fifty sluice-heads, and fifty more could with equal advantage be used for irrigation and domestic purposes. This would give a quantity equal to 14,400,000 gallons for the day, and 7,200,000 gallons during twelve hours for the night, together making 21,600,000, which, multiplied by 182 days, being a six months' supply, gives a total of 3,931,200,000 gallons, and equal to a reservoir of 400 acres, at an average depth of 36 feet."

At one time there were sixteen parties, of five men each, engaged in sluicing the surface of Ballaarat Hill, Hard Hills, and the neighboring gullies, the water being supplied by Messrs. Stewart and Farnsworth. They worked day and night, each party paying £5 for the water by day and £4 for it by night; and some of them made from £15 to £20 per week per man.*

Similar large yields have been regularly obtained at Mount Blackwood.†

The bed of the Jim Crow Creek was sluiced many years ago, and the yield of gold was considerable. In many cases the clear earnings of the miners ranged from £6 to £8 per week.

In the Fryer's Creek District in past years the yields have been good, as appear from the reports of the mining surveyor:—

"One party, who had an extended claim in the bed of the River Loddon, realized, during a period of three years, sufficient to make their average earnings equivalent to 25s. per man per day, exclusive of all incidental expenses. They worked the ground with the assistance of a water-wheel six feet in diameter, which, with a fall of water equal to sixty-nine square inches, is equivalent to one horse-power. This wheel served two purposes: first it enabled them to keep their excavations moderately dry by pumping, and secondly it could be so applied as to work a small puddling machine, thus greatly economising labor. They washed the whole of the earth in their claim,

* *Mining Surveyors' Reports*, September, 1861, p. 390, vol. III.

† *Mining Surveyors' Reports*, October, 1861, p. 433, vol. III.

and gold appeared equally distributed throughout—that is, the earth from the surface to the bed rock—a depth of six or ten feet. Another party of five (Englishmen) had a claim on the banks of the Loddon at the junction of Fryer's Creek, equal in area to half an acre, which they worked by paddocking. After sinking through about eleven feet of black loamy soil there is a stratum of red gravel and stones intermixed with small quartz pebbles extending to the bottom (black slate), the whole of which (eight feet) was washed through sluices, the yield varying from $\frac{1}{2}$ oz. to $1\frac{1}{2}$ oz. per load. One man could wash seven loads per diem."

Some of the sluicing claims in the Beechworth District have been valued as high as £2,500; and one, which had been turned over twice, yielded, on being worked a third time by four men, 85 ozs. of gold in one week.

When it is considered that a miner is able to reduce, on an average, by the aid of a sufficient supply of water, as much as twenty or thirty tons of earth per diem, it is obvious that, when the schemes now being elaborated by the Government are perfected, many thousand acres of, under existing circumstances quite worthless, auriferous land, will be eagerly attacked by the miner and made to give up the gold which they contain. Rich auriferous alluviums—lying at an elevation which the races of the miner cannot at present command, and flats and gullies, almost exhausted by the appliances in use—will all become valuable when water is cheap and plentiful.

The minute division of the waters in the Beechworth District—the network of races—the almost embarrassing multiplicity of small reservoirs—show how the miner could utilize a large stream if he had the command of it; and show, at the same time, how ineffective for industrial purposes is any small tentative scheme of water supply.

When the board appointed by the Honorable John Macgregor, the Minister of Mines, investigated the applications for water rights at Beechworth, it was discovered that there were, within an area of less than forty-six square miles, seventy-seven races, having an aggregate length of 159 miles, and diverting, theoretically, 32,651,000 gallons of water per diem.

This quantity of water is not actually available. It is true that water which runs from one claim is often caught and used in another; but, making every allowance, it cannot at all approach the quantities named in the applications for licenses.

In Gippsland, all over the Beechworth District, at Ballarat, Daylesford, Castlemaine, and in the Maryborough District, the miners have diligently turned to account the waters of the streams.

It will be interesting to the miners of this country to learn, from a trustworthy source, how sluicing operations and hydraulic mining are conducted in California; and the following notes, by Mr. John S. Hittell,* contain a concise account of them:—

"*The Sluice.*—The board-sluice is a long wooden trough, through which a constant stream of water runs, and into which the auriferous dirt is thrown. The water carries away the clay, sand, gravel, and stones, and leaves the gold in the bottom of the sluice, where it is caught by its gravity, and by quicksilver. The board-sluice is the great washing machine, and the most important instrument used in the placer mining of California. It washes nearly all the dirt, and catches nearly all the placer gold of the country. It was invented here, although it had previously been used elsewhere. It has been more extensively employed here than in any other country, and it can be used here to more advantage than elsewhere. It is not less than fifty feet long, nor less than a foot wide, made of boards. The width is usually sixteen or eighteen inches,

* *The Resources of California*, by John S. Hittell, 2nd edition, 1866.

and never exceeds five feet. The length is ordinarily several hundred, and sometimes several thousand, feet. It is made in sections or boxes, twelve or fourteen feet long. The boards are an inch and a half thick, and are sawn for that special purpose, the bottom boards being four inches wider at one end than the other. The narrow end of one box, therefore, fits in the wide end of another, and in that way the sluice is put together—a long succession of boxes, the lower end of each resting in the upper end of another, and not fastened together otherwise. These boxes stand upon trestles, with a descent varying from eight to eighteen inches in twelve feet. It is, therefore, an easy matter to put up or take down a sluice after the boxes are made, and it is not uncommon for the miners to haul their boxes from one claim to another. The descent of a sluice is usually the same throughout its length, and is called its grade.

“If there be a fall of eight inches in twelve feet, the sluice has an eight-inch grade, and if the fall be twice as great, it is a sixteen-inch grade.

“The grade depends upon the character of the pay-dirt, the length of the sluice, and its position. The steeper the descent the more rapidly the dirt is dissolved, but the greater the danger also that the fine particles of gold will be carried away by the water. The tougher the dirt, that is, the greater its resistance to the dissolving power of the water, the steeper, other things being equal, should be the grade. A slow current does not dissolve tough clay, and that is the greater part of the pay-dirt, so rapidly as a swift one. The shorter the sluice, other things being equal, the smaller the grade should be. There is more danger that the fine particles of gold will be lost by a short sluice than by a longer one, and to diminish this danger, the rapidity of the current must be reduced by a small grade. The greater the amount of dirt to be washed, other things being equal, the steeper should be the grade; for a swift current will wash more dirt than a slow one. In many claims the pay-dirt is full of large stones and boulders, weighing from one hundred to five hundred pounds each, all of which must be carried away through the sluice. Some are sent down whole, and others are broken into pieces with sledgehammers before they are thrown into the box. These require a swift current and a large body of water. The larger the supply of water the steeper the sluice is made, other things being equal. Of course economy and convenience of working require that the sluice should be near the level of the ground, and as that may be steep or level below the claim, the grade of the sluice must to some extent conform to it. There are thus a multitude of points to be taken into consideration in fixing the grade of a sluice; but a fall of less than eight or more than twenty inches in a box of twelve feet, would be considered as unsuitable for the board-sluice. Sometimes the upper part of the sluice is made steeper so as to dissolve the dirt, and the lower part has a small grade to catch the gold. The clayey matter of ordinary pay-dirt is fully dissolved in a sluice 200 feet long with a low grade, so the use of the boxes beyond that length is merely to catch the gold. There are claims, however, in which the clay is so extremely tough that it will roll in large balls more than a quarter of a mile through a steep sluice with a large head of water, and come out at the lower end scarcely diminished in size.

“The gold is caught in the sluice-boxes by false bottoms of various kinds. It would not do to leave the boards smooth, for the water would sweep all the gold away, and the boards themselves would soon be worn through. The most common false bottom is the longitudinal riffle-bar, which is from two to four inches thick, from three to seven inches wide, and six feet long. Two sets of these riffle-bars go into each sluice-box, the box being twice as long as the bar. A set of riffle-bars is as many as fill one-half of a box. They are wedged in, from an inch to two inches apart; the

wedging being used because the bars can more readily be fastened in their places, and more easily be taken up than if nails were used. Before the work of sluicing commences, all the boxes are fitted with riffle-bars, and the bottom of the sluice is therefore full of holes from one to two inches wide, from three to seven inches deep, and six feet long. These are the places in which the gold, quicksilver, and amalgam are caught. Quicksilver is used now in nearly all the sluices, and is the more necessary the smaller the particles of gold. The large pieces of the metal would all be caught by their specific gravity without the aid of amalgamation.

"The sluice-boxes having been made, and set up with the proper grade, the water is turned in. The boxes are made of the rough boards as they come from the saw, and the joints are not waterproof, but the leaks are soon stopped by the swelling of the wood, or by the dirt. The stream of water in the sluice is at least two inches deep over the bottom. The height of the sides of the boxes is from eight inches to two feet. The sluice usually runs through the claim, and the auriferous dirt is thrown in with shovels, of which from four to twenty are constantly at work. A man will throw in from two to five cubic yards of dirt in one day. The water rushing over the dirt as it lies in the box, rapidly dissolves the clay and loam, and then sweeps the sand, gravel, and stones down. The first dirt in the box goes to fill the spaces between the riffle-bars. After the sluicing has been in progress a couple of hours, some quicksilver is put in at the head of the sluice, and it gradually finds its way downwards, most of it stopping, however, near where it is put in.

"*Cleaning up.*—The separation of the gold, amalgam, and quicksilver from the dirt in the bottom of the sluice is called 'cleaning up;' and the period between one cleaning up and another is called a 'run.' A run in a common board-sluice usually lasts from six to ten days. Ordinarily, the sluice runs only during daylight, but in some claims the work continues night and day. Cleaning up occupies from half a day to a day, and therefore must not be repeated too often, because it consumes too much time. In some sluices the cleaning up does not occur until the riffle-bars have been worn out or much bruised by the wear of the stones and gravel. Cleaning up is considered light and pleasant work as compared with other sluicing, and is often reserved for Sunday. At the time fixed the throwing in of dirt ceases, and the water runs until it becomes clear. Five or six sets of riffle-bars, a distance of thirty or thirty-five feet, are taken up at the head of the sluice, and the dirt between the bars is washed down, while the gold and amalgam lodge above the first remaining set of riffle-bars, whence it is taken out with a scoop or large spoon, and put into a pan. Five or six more sets of bars are taken up, and so on down. Sometimes all the riffle-bars are taken up at once, save one set in every thirty-six feet, and then the work of cleaning up is despatched much more rapidly. The quicksilver and amalgam taken from the sluice are put into a buckskin or cloth, and pressed, so that the liquid metal passes through and the amalgam is retained. The amalgam is then heated, to drive off the mercury. This may be done either in an open pan or in a close retort; in the former the quicksilver is lost, in the latter it is saved. The pan is generally preferred. Often a shovel or plate of iron is used. Three pounds of amalgam, from which the liquid metal has been carefully pressed out, will yield one pound of gold. The gold remaining after the quicksilver has been driven off by heat from the amalgam is a porous mass, somewhat resembling sponge-cake in appearance.

"*Riffle-bars.*—The riffle-bars are usually sawn longitudinally with the grain of the wood, but block riffle-bars are considered preferable; the latter are cut across the tree, and the grain stands upright in the sluice-box. The block riffle-bars are three

times more durable than the longitudinal, and as the latter kind are worn out in a week in some large sluices, there is a considerable saving in using the former. The block riffle-bars are only two or three feet long. In some small sluices the riffle-bars are not placed in the boxes longitudinally nor in sets, but one bar near the head runs downwards at an angle of forty-five degrees to the course of the box, not touching its lower end to the side of the box, but leaving an open space of an inch there. Just below this open space another bar starts from the side of the box and runs downward at right-angles to the course of the first bar, and an open space is again left at the end of this bar; and so on down to near the lower end of the sluice, where there are longitudinal riffle-bars in sets as described in the preceding paragraphs. The consequence of using this kind of riffle-bar is that though much of the water and light dirt runs straight over the bars, the heavier material runs down from side to side in a zigzag course. Near the head of the sluice is a vessel from which quicksilver falls by drops into the box, and it follows the course of the riffle-bars, overtaking the gold which takes the same route. These zigzag riffle-bars are nailed down. In all sluices men must keep watch to see that the boxes do not choke; that is, that the dirt and stones do not collect in one place, so as to make a dam, and cause the water to run over the sides and thus waste the gold.

"There are small sluices from which all stones as large as a doubled fist are thrown out. For this purpose the miners use a sluice-fork, which is like a large manure-fork or garden-fork, but has tines which are blunt and of equal width all the way down; the bluntness being intended to prevent the tines from catching in the wood, and the equality of width to prevent the stones from getting fast in the fork. In some sluices the block riffle-bars—that is, bars cut across the grain of the tree—are set transversely in the boxes, and about two inches apart.

"Another device is, to fill the pores of such riffle-bars with quicksilver. This is done by driving an iron cylinder with a sharp edge into the surface of the bar, then putting mercury into the cylinder and pressing into the wood. The quicksilver, thus fastened in the wood, catches particles of gold, which must be scraped off when the time for cleaning up comes.

"*Double Sluices.*—Sluices are sometimes made double—that is, with a longitudinal division through the middle, so that there are two distinct sluice-boxes side by side. Two companies may be working side by side, so that it will be cheaper for them to build their sluices jointly. In some places the amount of water varies greatly; so that in the winter there is enough to run two sluices, and in the summer only one. And there are companies which wish to continue washing without interruption; so they wash first on one side and then on the other, and clean up without any interruption to the process of washing.

"Another device for saving gold in sluices is the under-current box: There is a grating of iron bars in the bottom of a box, near the lower end of a sluice, and under this grating is another sluice, with an additional supply of clean water, and with a lower grade. The grating allows only the fine material to fall through; and the current of water being moderate, many particles of gold that would otherwise be lost are saved. Sometimes the matter from the under-current box is led back to the main sluice.

"*Rock Sluices.*—Large sluices are frequently paved with stone, which makes a more durable false bottom than wood, and catches fine gold better than riffle-bars. The stone bottoms have another advantage—that it is not so easy for thieves to come and clean up at night, as is often done in riffle-bar sluices; but, on the other hand,

cleaning up is more difficult and tedious in a rock-sluiice, and so is the putting down of the false bottom after cleaning up. The stones used are cobbles, six or eight inches through at the greatest diameter, and usually flattish. A good workman will pave 800 square feet of sluice-box with them in a day; and after the water and dirt have run over them for an hour, they are fastened very tightly by the sand collected between them. In large sluices wooden riffle-bars are worn away very rapidly—the expense amounting sometimes, in very large and long sluices, to twenty or thirty dollars a day; and in this point there is an important saving by using the stone bottoms. They are used only in large sluices, and they generally have a grade of twelve or fourteen inches to the box of twelve feet.

“Hydraulic Mining.—After the board-sluiice, with its various adjuncts of riffle-bars, stone bottoms, copper plates, and so forth, the next instrument of importance in the gold mining of California is the hydraulic hose, used to let water down from a considerable height, and throw it, under the pressure of its own weight, against the pay-dirt, which is thus torn down, broken up, dissolved, and carried into the sluice below. The sluice is a necessary part of hydraulic mining. The hose is used, not to wash the dirt, but to save digging with shovels, and to carry it to the sluice. The hydraulic process is applied only in claims where the dirt is deep, and where the water is abundant. If the dirt were shallow in the claim and its vicinity the necessary head of water could not be obtained. Hydraulic claims are usually in hills. The water is led along on the hill, at a height varying from 50 to 200 feet above the bed-rock, to the claim at the end or side of the hill, where the water, playing against the dirt, soon cuts a large hole, with perpendicular or at least steep banks. At the top of the bank is a little reservoir, containing perhaps not more than 100 gallons, into which the water runs constantly, and from which the hose extends down to the bottom of the claim. The hose is of heavy duck, sometimes double, sewn by machine. This hose when full is from four to ten inches in diameter, and will bear a perpendicular column of water fifty feet high, but a greater height will burst it. Now as the force of the stream increases with the height of the water, it is a matter of great importance to have the hose as strong as possible, and for this purpose, in some claims, it is surrounded with iron bands, which are about two inches wide, and are connected by four ropes which run perpendicularly down. The rings are about three inches apart. The ‘crinoline hose,’ thus made, is very flexible, and will support a column of water 150 or 200 feet high. The pipe at the end of the hose is like the pipe of a fire-engine hose, though usually larger. Sometimes the pipe will be eight inches in diameter where it connects with the hose, and not more than two inches at the mouth; and the force with which the stream rushes from it is so great, that it will kill a man instantaneously, and tear down a hill more rapidly than could 100 men with shovels.

“One or two men are required to hold the pipe. They usually turn the stream upon the bank near its bottom until a large mass of dirt tumbles down, and then they wash this all away into the sluice; when they commence at the bottom of the bank again, and so on. If the bank is 150 feet high, the mass of earth that tumbles down is of course immense, and the pipemen must stand far off, for fear that they will be caught in the avalanche. Such accidents are of daily occurrence, and the deaths from this cause probably are not less than threescore every year in the State. Often legs are broken; still more frequently the pipemen have warning, and escape in time. When men are buried in the falling dirt, the water is used to wash them out. In some claims, the pipe will tear down more dirt than the sluice can wash;

in other claims, the sluice always demands more dirt than the pipe can bring down. In the latter case, blasting may be used to loosen the dirt, or the miners may undermine the bank, leaving a few columns of dirt for support; and then these being washed away by the pipe, the whole bank comes tumbling down. In hydraulic claims, all the dirt is washed; in all other kinds of claims, such dirt as contains no gold is thrown to one side, or 'stripped off.' 'Hydraulic Mining' is the highest branch of placer mining; it washes more dirt, and requires more water and a larger sluice, than any other kind of mining. The number of men employed in a hydraulic claim, however, is usually small, from three to six, the water doing nearly all the work. In some claims a man is constantly employed with a heavy sledge-hammer in breaking up large stones, so that the pieces may be sent down the sluice. One man attends to the sluice, and sees that the dirt does not choke up in the sluice, or in the claim above it.

"The quantity of dirt that can be washed with a hydraulic pipe depends upon various circumstances—such as the supply of water, the height of its fall, the toughness of the dirt, and the amount of moisture in it.

"More can be washed in winter than in summer, because the dirt is then moister, and requires less water to loosen and dissolve it. The quantity of water used in a hydraulic claim is from 40 to 200 inches. With 100 inches, at least thirty cubic yards can be washed in ten hours, on an average; and three men can do all the work. If there were a cent's worth of gold in each cubic foot, the thirty cubic yards would yield 8 dollars and 10 cents per day, or 2 dollars and 70 cents to the man, exclusive of the cost of water. But, as a matter of fact, nearly all the hydraulic claims pay more than that, and they will average at least 3 cents to the cubic foot, and many of them yield 5 cents. The water usually costs 20 cents an inch per day, so that 100 inches would cost 20 dollars. Allowing for the water at that rate, a claim in which thirty cubic yards could be washed in a day with 100 inches of water, and in which the dirt contained 5 cents to the cubic foot, would leave a net pay of 6 dollars and 66 cents to each man per day. One hydraulic company, of whose labors I have a note, washed 224,000 cubic feet of dirt in six days, using 200 inches of water, and employing ten men. The wages of the men amounted, at 4 dollars per day each, to 240 dollars; the water cost 300 dollars; and the waste of quicksilver, and wear of sluice, perhaps 100 dollars more, making a total expenditure of 640 dollars; and the gold obtained was 3,000 dollars, leaving a clear profit of 2,350 dollars. The dirt contained one cent and a-fifth of gold in a cubic foot. The greater the amount of water used the greater the proportionate amount of dirt that can be washed, and the greater the proportionate profits. It is far more profitable to have a large sluice than a little one, if the water and dirt can be obtained in abundance.

"Usually, in a hydraulic claim, the dirt is washed down to the bed-rock; but in some places the washing stops far above the bed-rock, because there is no outlet for the water.

"*Blasting*.—In some hydraulic claims, the dirt, in dry seasons, is blasted, so as to loosen it. A drift or hole is cut into the bottom of a hill one or two hundred feet high, and a number of kegs of powder (from 20 to 200) are introduced, and they are fired with a slow match. The explosion makes an earthquake in the vicinity; and the ground is loosened to such an extent that there is a great saving of labor. The breaking up of the dirt and the exposure to the air are supposed to facilitate the washing greatly. More water is required for piping down banks than for washing the dirt; and often the sluice is almost idle for want of dirt, while the water, after being

thrown against the hill-side, runs away without doing any service at washing. Blasting, therefore, by loosening the earth, enables the hydraulic miner to have an abundant and regular supply of dirt in his sluice, at an expense much less than the cost of manual labor to dig the bank down with pick and shovel.

"Tail-Sluice."—The tail-sluice is a large sluice made for rewashing the tailings or dirt which has previously passed through other sluices. It is placed ordinarily in the bed of a ravine or creek through which tailings run, and it receives no attention for weeks or months at a time, save to keep it from choking. The sluices emptying into it furnish both dirt and water, and in the dirt there is always a large amount of fine gold, as is plainly proved by the fact that some of the tail-sluices have paid large profits to their owners. Tail-sluices are always large, long, and paved with stones; and sometimes they are double, so that one side may be cleaned up while the other continues washing. In a branch of the Yuba there is, or was not long since, a tail-sluice twenty feet wide.

"Tunnel-Sluice."—A tunnel-sluice is a sluice in a tunnel. It sometimes happens that a considerable body of water runs out through a tunnel; and in such case, a sluice at the bottom of the tunnel offers the easiest method of getting out and washing the dirt. The tunnels are never cut level, but with a slightly-ascending grade, so that the water will always run out. The grade is so low, that transverse riffle-bars must be used; for with longitudinal riffle-bars or stones, there would be too much danger of choking. These tunnel-sluices, because of their low grades, require much more attention than any other kind of sluices.

"Ground-Sluice."—All the sluices hitherto mentioned and described have wooden boxes, but the ground-sluice has no box; the water runs on the ground. The place selected for the ground-sluice is some spot where there is a considerable supply of water, a steep descent for it, and much poor dirt. The stream is turned through a little ditch, which the miners labor to deepen and enlarge, and when it is deep they prize off the high banks, so that the dirt may fall down into the ditch. This is a very cheap and expeditious way of washing, but it is not applied extensively. It is used to the most advantage for washing where the water is abundant for only a few weeks after heavy rains, and where it would not pay to erect large sluices. A few cobble-stones should be left or thrown at intervals in the bed of the ground-sluice, to arrest the gold, for if the bed were smooth clay, the precious metal might all be carried off. Quicksilver is not used in the ground-sluice. After the dirt has all been put through the ground-sluice, it is cleaned up in a short board-sluice, or a tom.

"Long-Tom."—The tom or long-tom, an instrument extensively used in the Californian mines in 1851 and 1852, but now rarely seen, is a wooden trough about twelve feet long, eighteen inches wide at the upper end, and widening at the lower to thirty inches, with sides eight inches high. It is used like a board-sluice, but has no riffle-bars, and at the lower end its bottom is of sheet-iron, perforated with holes half an inch in diameter. This sheet-iron is turned up at the lower end, so that the water never runs over there, but always drops down through the perforated sheet-iron or riddle, into a little riffle-box, containing transverse riffle-bars. A stream of water of about ten inches makes a 'tom-head'—or the amount considered necessary for a tom—through the tom, which has a grade similar to that of a board-sluice. The dirt is thrown in at the head of the tom, and a man is constantly employed in moving the dirt with a shovel, throwing back such pieces of clay as are not dissolved, to the head of the tom, and throwing out stones. From two to four men can work with a tom; but the amount of dirt that can be washed is not half that of a sluice. The tom may be

used to advantage in diggings where the amount of pay-dirt is small and the gold coarse. The riffle-box contains quicksilver, and as the dirt in it is kept loose by the water falling down on it from the riddle above, a large part of the gold is caught ; but where the particles are fine, much must be lost."

These descriptions are inserted both because they are valuable in themselves and because of the importance to the miner of gaining as much information as possible respecting the best modes of using water, now that there is an immediate prospect of getting large supplies of it on the older goldfields, where large areas of auriferous ground which have been more than once turned over are likely to lie unwrought if some cheap and economical system of washing be not introduced. The methods so well described by Mr. Hittell are not, however, set down as patterns which should be carefully copied. The physical character of our goldfields does not resemble those of California, and skill and ingenuity will be required to turn to the best uses the water which may be supplied.

They furnish data from which conclusions may be drawn as to the probable value of our abandoned workings; and to the same end the following remarks of Mr. William P. Blake, as quoted by Sir William E. Logan,* are appended. Speaking of hydraulic mining in California, he says:—"In this method the force of a jet of water, with great pressure, is made available, both for excavating and washing the auriferous earth. The water issuing in a continuous stream, with great force, from a large hose-pipe like that of a fire-engine, is directed against the base of a bank of earth and gravel, and tears it away. The bank is rapidly undermined, the gravel is loosened, violently rolled together, and cleansed from any adhering particles of gold; while the fine clay and sand are carried off by the water. In this manner hundreds of tons of earth and gravel may be removed, and all the gold which they contain liberated and secured with greater ease and expedition than ten tons could be excavated and washed in the old way. All the earth and gravel of a deposit is moved, washed, and carried off through long sluices by the water, leaving the gold behind. Square acres of earth on the hill sides may thus be swept away into the hollows without the aid of a pick or a shovel in excavation. Water performs all the labor, moving and washing the earth in one operation; while in excavating by hand the two processes are of necessity entirely distinct. The value of this method, and the yield of gold by it, as compared with the older one, can hardly be estimated.

"The water acts constantly, with uniform effect, and can be brought to bear upon almost any point, where it would be difficult for men to work. It is especially effective in a region covered by trees, where the tangled roots would greatly retard the labor of workmen. In such places the stream of water washes out the earth from below, and tree after tree falls before the current, any gold which may have adhered to the roots being washed away. With a pressure of sixty feet, and a pipe of from one and a half to two inches aperture, over 1,000 bushels of earth can be washed out from a bank in a day.

"Earth which contains only one twenty-fifth part of a grain of gold, equal to one-fifth of a cent in value, to the bushel, may be profitably washed by this method; and any earth or gravel which will pay the expense of washing in the old way, gives enormous profits by the new process. To wash successfully in this way requires a

* *Geological Survey of Canada—Report of Progress*, by Sir William E. Logan, L.L.D., F.R.S., F.G.S., Director, 1863.

plentiful supply of water at an elevation of from fifty to ninety feet above the bed-rock, and a rapid slope or descent from the base of the bank of earth to be washed, so that the waste water will run off through the sluices, bearing with it gravel, sand, and the suspended clay. * * * * *

"In the case of a deposit in North Carolina, where ten men were required for thirty-five days to dig the earth with pick and shovel, and wash it in sluices, two men with a single jet of water would accomplish the same work in a week. The great economy of this method is manifest from the fact that many old deposits in the river beds, the gravel of which had been already washed by hand, have been again washed with profit by the hydraulic method.

"In California the whole art of working the diluvial gold deposits was revolutionized by this new method. The auriferous earth lying on hills, and at some distance above the level of the watercourses, would, in the ordinary methods, be excavated by hand, and brought to the water; but, by the present system, the water is brought by aqueducts to the gold deposits, and whole square miles, which were before inaccessible, have yielded up their precious metal. It sometimes happens, from the irregular distribution of the gold in the diluvium in California, that the upper portions of a deposit do not contain gold enough to be washed by the ordinary methods, and would thus have to be removed, at a considerable expense, in order to reach the richer portions below. By the hydraulic method, however, the cost of cutting away and excavating is so trifling that there is scarcely any bank of earth which will not pay the expense of washing down in order to reach the richer deposits of gold beneath." The miner has not, however, overcome all difficulties even when he has brought the hose to bear on the auriferous earth. It must be borne in mind that abandoned ground which has been turned over several times, silt from puddling mills, and accumulations of sludge and tailings contain, generally, only fine gold, and that the rough methods of working which have proved so profitable in California, and have been adopted there to so great an extent, would utterly fail in many places in this colony. Something more than water is required if we have to deal with earth containing fine gold in flakes.

At Sandhurst the miners obtained a good deal of gold at one time from the sludge by running it over rough cloths which had been rubbed with mercury; but a score of better methods than they used will be devised as soon as water is available in large quantities.

Hydraulic mining will be practicable in only a few places. The character of the earths which occur on our goldfields, and the position of the auriferous alluvium, lying, as much of it does, at low levels, will prevent the general use of this method; but improved modes of sluicing on a large scale will certainly be invented when the miners are able to obtain water at a reasonable price.



Deep Sinking.



When we leave the quite recent drifts, which are deposits due to forces now in operation, and where we can trace the gold to its source (either to the auriferous reef on the hill or to the older gravels which the modern stream has cut into and transported), and proceed to consider the character, position, extent, and age of the auriferous tertiaries, we meet with many difficulties. It is not possible to do more than guess at the age, and the evidence most often has to be sought for, not in the fossils which they contain, but in the relation which these tertiaries bear to other adjacent formations.

But though it is true that the geological age cannot yet be fixed with that precision which is desirable, the limits are sufficiently well defined for all practical purposes. The deep leads which up to this time have been explored are not older, it is supposed, than the pliocene; it is believed that no *marine* production has yet been found associated with gold drifts, and miners are nowhere employed in getting gold from drifts underlying fossiliferous strata of marine origin. All these statements may appear to accord with the old theories, and thus satisfy the indolent mind, but they must be received with caution. Negative evidence is sometimes rudely destroyed. Thus it has been affirmed that marine fossils have been found in the deep leads at Creswick, but whether truly or not it is impossible at present to say. Gold has been found, it is alleged on the authority of a person whose character is above suspicion, in the Geelong tertiaries, but gold dust may have been lost and scattered at the point from whence he took the earth. Moreover the deep leads and other strata have been but imperfectly explored, and at any moment all the old theories may be upset by the finding of gold in large quantities in fossiliferous rocks of the tertiary or secondary age.

Deep leads are not traceable for the purposes of the miner, within reasonable limits, by the indications or trend of the natural surface of the land in the places where they occur. A gully having its sources in some range composed of palæozoic rocks has a course which for some distance is well marked by the strata of sand, gravel, and water-worn quartz pebbles which fill the lower part of the valley; but when we follow it onwards and towards the low level plains through which the modern stream has cut a channel, the strata increase in thickness, and it is no longer possible to mark the course of the old bed of the stream. It is hidden by layers of sand and drift; and though we may ascertain the direction of the bounding ranges, and lay down on a map the probable course of the old channel, the distance between the ridges which form the valley is considerable; and it is often doubtful when the miner marks out a claim whether it will include any considerable length of the gutter.

And in those parts where basaltic lavas overlie the drifts it is still more difficult to find the leads. Where they plunge under an escarpment of basalt, or are lost in a wide expanse of level plains, all the knowledge which the practical miner or geologist can bring to his aid is sometimes insufficient for the purposes of the miner.

It is true that the leads nearly everywhere run almost parallel to the modern streams, which now convey the storm-waters they carried at one time; but the smaller deflections are numerous, and there are many departures from the theoretical course; and the difficulty of clearing the mines of water is so great as to render the work of prospecting both costly and uncertain. It happens too that a lead—rich for a considerable distance—in some places widens considerably, and changes its character, and ceases to repay the miner for his labor.

Where a lead is covered by basalt, as at Ballaarat, it is quite impossible to determine its course accurately, except by expensive explorations underground; or approximately, otherwise than by bore-holes. The indications observable on the surface are more likely to mislead than serve as a guide; but in some localities, as at Myer's Creek and Huntly, the direction can be determined for theoretical purposes within reasonable limits, because the outcropping bed-rocks on each side can be seen, and their height above the wide low level valley fixed. Yet in such places as these it is not easy for the miner to follow the run of rich ground; and where the width is a mile or two miles, it is easily lost. A number of small claims on the supposed course prove unremunerative, vast labor is expended uselessly, and the place is perhaps abandoned; but the lead is surely there, and by co-operation—by making bores across the valley, so as to determine the depth of the bed-rock—it would be easy to save unnecessary expenditure of time and labor and money, and to trace the gutter for miles onward.

In the deep ground at Ballaarat, and other goldfields, large trees, scarcely altered except on the outer surface and so well preserved as to admit of being carved and made into articles of furniture, are from time to time met with in the black clays overlying the washdirt. Because the surface is carbonized it has been thought by some that the trunks have been burnt by bush fires, or by contact with molten lava; but in most cases (not in all) the appearance is due to gradual changes effected by the same forces which have converted forests into seams of coal.

The following interesting account of the explorations of the Great North-west Company, at Ballaarat, has been furnished by Mr. Wheeldon, the manager, who has sent also a section of the shaft and bore, and specimens of the rocks, lignite, and fossil wood which have been found in their claim.

"The surface soil, he observes, is thin, there being only a few inches of dark soil over a thin layer of sandy loam, at the base of which numerous small pebbles of brown ironstone occur. Between this and the first layer of basaltic rock there is some yellow clay (decomposed basalt) varying in thickness from a few inches to two feet. The first basaltic rock (which in some places in the locality crops out on the surface) was got through at a depth of thirty-three feet. Between this and the second rock is a layer of red clay resembling badly-burnt bricks, intersected by numerous vertical or nearly vertical cracks, and containing no quartz fragments or vegetable remains. It is eleven feet in thickness. The second basaltic rock is 144 feet in thickness, and in texture is close and hard, except at the top where it is vesicular. In sinking, water was struck at the top of this rock, and whenever the pumps stopped water rose to the height of about eleven feet above it; and as the sinking progressed, the water poured into the shaft through the cracks near the bottom.

"Under the second rock occur twenty-eight feet of variously-coloured clays, with small pieces of quartz in places. Immediately under the rock the clay is nearly black, and appears to be mixed with wood ashes, and lower down it is brown. Under this brown clay there is white clay, mixed with sand and quartz, two feet in thickness, becoming darker towards the base, and overlying two feet of quite black compact lignite. Underlying the lignite the color of the clay is green. The third layer of basaltic rock is fifty-seven feet in thickness. It is vesicular, and everywhere shows shrinkage cracks which divide the rock into masses varying from four to six feet in diameter, the divisional lines being filled with saponaceous clay.

"Under the third rock is a layer of clay about eleven feet in thickness, which at the top is black, resembling that found under the second rock, and like it is mixed with what appear to be ashes. Close to the top of this clay the remains of a tree were met with. The trunk apparently had been burnt off. The upper parts were carbonized and resembled hard charcoal, and the fractures showed a glossy surface, almost like coal. As the roots were traced downwards into the clay the effects of heat were not visible. The wood had the natural appearance of roots which are now found at the surface, and even the small fibres were in a remarkable state of preservation. This clay, except at the top and towards the bottom, was of a light green colour, and cracks like those seen in the clay between the second and third rocks were visible. The fourth layer of basaltic rock was met with at a depth of 284 feet, and up to the present time twenty-seven feet of it have been sunk through. In its character it more resembles the third than the first or second, but it is of a lighter colour. The divisional spaces are filled with a soapy clay and some stuff resembling black saw-dust.

"Obsidian has been found in this layer, and in one place was observed a piece of basalt with gravelly clay and small pieces of quartz adhering to it. There have been discovered also some boulders having the appearance of being water-worn—some quite round, and others having only the corners worn off—which answer the description given by Poulett Scrope of the smooth boulders formed by attrition in the crater. The company have bored down to the schist rock, which was struck at 355 feet from the surface, and the bore shows that the shaft has still to be put through twenty-one feet of the fourth layer of basaltic rock and twenty-three feet of clay, &c. The upper part of the clay (two feet) is black and overlies sandy clay with pieces of quartz; and dark yellow and brown and nearly black clays rest on the bed-rock. The quantity of water pumped out at present is 2,000 gallons per minute."

Let us hope that this enterprise, which has already cost nearly £40,000, will, under the superintendence of Mr. Wheeldon, prove successful, and help towards the development of the large basaltic areas between Wendouree and Burrambeet.

His interesting account of the layers met with in the shaft shows that, if properly read, each of them chronicles an event in the geological history of the recent period. The black clays, mixed with ashes, which underlie the layers of basalt are but the altered surface of the once grass-clad soil, and the lignites and the trees embedded in the clay give some hint of the lapse of time between the eruptions.

The deep beds of lignite near Lal-Lal, in the close vicinity of centres of volcanic eruptions, have not been affected by heat. The materials composing the beds would have changed their form and character altogether had they been subjected to it; and as regards Daylesford, the same may be said. Mr. T. E. Leake thus reports on the Exchequer Company's claim, Wombat Lead—in *Dicker's Mining Record*, of the 12th



From a photograph by H. Dainton.

LAL LAL FALLS, NEAR BUNINYONG.

September, 1865 :—"The Daylesford district is an exceedingly interesting one to the geologist. Its narrow dykes of great but unknown depths filled in with basalt; its extensive deposit of infusorial remains more than 100 feet in thickness, the accumulation, in all probability, of countless ages; its deposit of leaves, in what might be termed an underground swamp, every lump of hard black mud or clay taken from which opens like a book, and contains within itself a complete history, illustrated by leaves of rushes and trees, to all appearance the same as we see growing at the present day, the leaves showing all their original form and structure; the wood got from the same deposit, part changed into pure lignite, part still retaining its fibrous character, other altogether decayed away, but leaving a perfect cast of its outward form in sulphide of iron, other again scarcely to be distinguished from wood at first glance is found to be wholly replaced by pyrites, presenting a bundle of fibres detached from each other, each one of a hard metallic character, and many as fine as the finest needles used by a lady; and its mineral springs offer to lovers of the curious in natural history studies of endless and varied interest scarcely to be surpassed in any other part of Victoria. In enumerating the curious natural productions that have been met with near Daylesford, one ought not to omit the tree converted into agate, or rather opalised, which was met with in the year 1858, in one of the tunnels near the old race-course. The length of the butt was about eight feet, and the diameter four to eight inches. From the top of this butt smaller limbs of the same character branched out in different directions."

Numerous specimens of the shales enclosing leaves were presented to the Mineral Collection of the Mining Department by Mr. H. Selwyn Smith, and that gentleman was, I believe, the first to draw attention to the circumstance that the leaves still preserve their fragrance. If the fossils are slightly rubbed with the finger the distinctive odour of the *Eucalyptus* is at once perceptible.

At Lal-Lal, the thickness of the lignite bed, in the centre of the basin, exceeds 100 feet. The Lignite Company sank through 62 feet of drifts and clays and more than 100 feet of lignite enclosing nests and patches of gums and resin, and found a thick stratum of drift-sand overlying the bed-rock.

These strata probably overlie auriferous drift; but the explorations in the deeper parts of the basin have not, as far as I am aware, disclosed gold.

Large trees are found very frequently embedded in the black clays, which overlie the washdirt, in the Ballaarat leads. One specimen, forwarded to the Dublin Exhibition by Mr. O'Mally, formerly mining surveyor at Ballaarat, was found in the Working-Miners' claim at Sebastopol, at a depth of 400 feet.

In the New Imperial Gold Mining Company's claim at Creswick, a large tree was found embedded in black drift, at a depth of 130 feet from the surface. It was lying in a horizontal position, was almost entire, and had numerous branches in good preservation. The strata overlying the drift are thus described :—

	Feet.
Basaltic rock - - - - -	100
Sand and gravel - - - - -	19
Very stiff black clay - - - - -	6
Black drift (with fossil tree) - - - - -	5
Total - - - - -	130

Mr. James Stevenson, mining surveyor, forwarded a portion of the tree to Melbourne.

Some years ago, a cunning sailor is said to have carved a piece of fossil wood, found in a lead at Creswick's Creek, into the shape of a human head of the pure Caucasian type, and to have imposed upon many persons. The figure was engraved, and some letters and documents, testifying to its authenticity, were published and circulated. One of the copies is now before me, and notwithstanding that the evidence in favor of the figure having been actually found in the drift, in the state in which it was placed before the draughtsman, is complete, and would be deemed sufficient in a court of law, there is nobody acquainted with the modes of occurrence of these relics and their condition when taken out of the earth, who would hesitate to pronounce it a forgery.

In the same place, cones, said to resemble exactly those of the *Banksia* or honeysuckle, occur in very many places in the drift.

Dr. Von Mueller, the Government Botanist, has examined some of the fossil plants found at Daylesford; but, he observes, the absence of eucalyptus fruit renders the identification or definition of the species very difficult, if not impossible. He expresses a hope that, when a greater number of specimens is available for examination, some more definite results will be obtained. In future, care will be taken to place at his disposal all the fossil flora which may be collected from our gold drifts.

In the Grand Trunk mine, at Smythesdale, Mr. Lynch says that fossil wood was found at a depth of 280 feet from the surface.

About two years ago, pieces of wood were taken from the drift under the basalt in the Britannia Company's claim, at Ararat, 152 feet from the surface. The wood is in perfect preservation.*

Mr. Joseph Smith, mining surveyor at Talbot, has collected a good deal of information respecting the fossils found in his district. In the Mount Greenock and Scandinavian Leads numerous pieces of wood have been discovered; and Mr. R. W. Wilkinson, of Talbot, forwarded a collection to the Exhibition of 1862, which attracted much attention. Impressions of leaves are found occasionally in the clays overlying the washdirt; and lately, a large tree was met with in a drive, which is thus described in the *Talbot Leader*, of the 17th April, 1868:—"A curiosity in the shape of a large tree was discovered some time ago embedded in the washdirt of the old shaft lately worked by the Pocahontas party, in Taaffe's paddock, and in depth about fifty feet. The tree was touched several times by the party while pushing forward their main drive, along the side of which it was deposited. The tree was of considerable length, but what appeared to be a large branch of it was found to cross the drive just about the time the party resolved upon abandoning the ground as unremunerative. The wood appears to be in a thorough state of preservation, and a piece of it was sawn off by one of the shareholders, Mr. Cayzer, for the purpose of polishing."

At Blackwood and Steiglitz, several specimens of wood, more or less mineralized, have been found in the leads; and at Tea-tree Creek, near the Moorabool, quite large trees were discovered in a stratum of dark clay, at a depth of 355 feet.

Mr. F. R. Pohlman, warden and police magistrate, collected many specimens of wood from the deep leads at Beaufort; and he obtained from the manager of the Royal

* C. J. W. Russell, mining surveyor, 13th April, 1868.

Saxon claim a section of the strata in which the lignites and trees occur. It is as follows :—

	Feet.
Sandy soil - - - - -	2
Yellow sandy clay - - - - -	15
Red and white clays (mixed) - - - - -	9
Fine drift, and quartz gravel, with much water - - - - -	3
Tough red and white clays (mixed) - - - - -	70
Yellowish clay - - - - -	6
Black sandy clay, with, here and there, pieces of rotten wood	3
Fine quartz gravel, with well preserved trunks of trees - - - - -	2
Quartz gravel, and large boulders of quartz, with gold - - - - -	3
Total depth - - - - -	113

In the Hope Company's claim, on the same goldfield, a stratum of black clay was cut which contained rotten wood and lignite.

In the leads at Wahgunyah, fossil wood, Mr. Arrowsmith says, has been found in some places, but not in great quantities. It was reported that in a well sunk in the basin towards which the leads trend fossil shells had been found; and as these leads are quite close to the Murray tertiaries, hopes were entertained that here at last we might be able to correlate the auriferous drifts with the fossiliferous tertiaries and determine their age—but if fossil shells were found they cannot now be produced. The clays which Mr. Arrowsmith has forwarded contain, I believe, the remains of foraminifera, but I have not had an opportunity of making a careful examination of them. The connecting the auriferous drifts with the tertiary fossiliferous rocks is now merely a question of time. At Crossover Creek, in Gippsland, near St. Arnaud, at Wahgunyah, and very probably near Huntly, we shall shortly have produced evidence which will serve to settle many doubtful points in regard to the geology of our recent auriferous rocks.

Mr. John A. Wallace says, that in the deep lead at Morse's Creek, large trees occur in the lower drifts in a good state of preservation.

Other fossils far more interesting than those mentioned above have been found in the gold drifts, and it is almost humiliating to have to state that no accurate description of them can be given here.

In a letter dated 2nd February, 1861, Mr. Johnson, who was then mining surveyor at Hepburn, described the position in which a jawbone and some other fossil bones were found in the Cunard Company's claim at Yandoit.

The Cunard Company's claim is situate in a wide flat surrounded by a high range of sandstone and clayslate hills, from which a number of small gullies empty into the flat; and the section of their shaft is as follows :—

	Feet.
Rich black loamy soil - - - - -	1
Clays and gravels - - - - -	30
Black clays—with layers of lignite and fossil leaves (about one inch in thickness), quartz, gravel, sand, &c. - - - - -	90
Total - - - - -	121

At a depth of 106 feet the principal fossil was discovered, and about ten feet above other bones were found.

Fossil bones have been discovered in an old lake-bed near Mount Greenock,* and in some places in caves by the Director of the Geological Survey, and his colleagues. It is certain that all of them present rich materials for the investigation of the palæontologist. The bones found at Mount Greenock, the jawbone taken from the shallow drifts at Fryer's Creek (apparently belonging to some marsupial), the fine collection made by Mr. Selwyn, the exceedingly interesting specimens obtained near Mount Alexander, and the skull and bones of the dingo (native dog) found under volcanic ash, at Tower Hill, will by and by be described, and much assistance will thereby be given to the geologist and the miner.

The occurrence of fossil wood in auriferous drifts is probably very common in all parts of the world—but it is not always that the discovery of such remains is recorded.† Our goldfields, in all likelihood, are not very different from many others in Europe and Asia, but whereas much information has been accumulated respecting those in Victoria, the others have been nearly wholly neglected. The few scanty facts which have been collected excite interest, but neither satisfy curiosity nor teach any lessons. In America, however, much attention has been given to the gold drifts by gentlemen competent to describe them—and the following extract would seem to show that a cross-section of the drifts and overlying basalt of Tuolumne County would not inaccurately represent what is found at Daylesford, in this colony.

Professor J. D. Whitney, State Geologist, in his *Geology of California*, 1865, thus describes the tunnelling operations under lava on the western slope of the Sierra Nevada, near the Table Mountain of Tuolumne County :—

"The Table Mountain of Tuolumne County is a flow of lava originating in the lofty volcanic region beyond the Big Trees of Calaveras ; * * * it comes down on the north side of the Stanislaus, forming a nearly-continuous ridge, elevated more than 2,000 feet above the river. * * * As seen from a distance, this Table Mountain reveals its origin at once in the contrast between the long straight line of its upper edge and the broken and curving ones which the eroded hills of the auriferous slates everywhere exhibit. * * * On approaching Table Mountain, and examining the material of which it is composed and the position which it occupies, it is seen at once that it is a vast lava flow, of which the upper surface remains very nearly at the level and with the form which it originally had at the time of its consolidation, while its edges and the surrounding country have been denuded and washed away, so that the topography of the region is entirely different from what it once was ; in fact, it is almost the reverse of it. * * * There must have been an amount of denudation during the period since this volcanic

* Mr. E. J. Bateman.

† "The auriferous sand occurring in Hungary almost always in the neighborhood of the beds of lignites, and the petrified wood covered with gold grains, found buried at a depth of fifty-five yards in clay, in the mine of Vorospatak, near Abrabanya, in Transylvania, might lead us to presume that the epoch of the formation of the auriferous alluvia is not remote from that of the lignites. The same association of gold ore and fossil wood occurs in South America, at Moco. Near the village of Lloro have been discovered, at a depth of twenty feet, large trunks of petrified trees, surrounded with fragments of trap rocks interspersed with spangles of gold and platinum."—Dr. Ure, in *Ure's Dictionary of Arts, Manufactures, and Mines*, edited by Robert Hunt, F.R.S., sixth edition, 1867.

mass took its present position of not less than three or four thousand feet of perpendicular depth, and yet this was all done during the most recent geological epoch. * * *

"Underneath the lava is a heavy deposit of a detrital material, very distinctly stratified, and lying nearly horizontal or with a slight dip each way towards the centre of the mass. These sedimentary beds are of variable characters, but are chiefly made up of a rather fine-grained sandstone, not very closely compacted, and which rapidly disintegrates on exposure. Interstratified with this sandstone, and especially near the bottom of the deposit, are fine argillaceous shales and clays, nearly white and often beautifully laminated. With these are beds of gravelly materials strongly cohering together, and called 'cement' by the miners, and at the bottom the 'pay-gravel' or the 'channel,' a body of coarse gravel, exactly like that seen in the bed of an ordinary river. The entire thickness of the detrital beds, directly under the centre of the lava, is, in one locality at least, fully 200 feet. * * * The auriferous gravel in the channel is from four to five feet thick. It will give some idea of the cost and time for opening a deposit of this kind when it is stated that this tunnel was commenced in October, 1855, and that the pay-gravel was not struck until March, 1860, the cost of the work up to that time having been about 38,000 dols.

"The stratified materials under the lava are frequently found to contain masses of wood, and even entire trunks of trees. These are very commonly found under Table Mountain, although not as abundant here as in some of the hydraulic washings in other parts of the State. * * * In the layers of finer sediment, called 'pipeclay' by the miners, which are very thinly and evenly bedded and made up of the finest particles of clay, impressions of leaves are occasionally found. Neither the wood nor the leaves from this and similar localities have as yet been minutely examined.

"A few specimens of the leaves from the Buckeye Tunnel were forwarded to Dr. Newberry, who made a preliminary investigation of them, and furnished us with some notes of his results, from which we are authorised to draw the conclusion that these stratified deposits underneath the lava of Table Mountain are of tertiary age, and that in all probability they belong to the later pliocene epoch. Dr. Newberry remarks that the leaves submitted to him are quite different from those of any trees now growing in California, and that they are specifically distinct from those of the miocene tertiaries of Oregon, Nebraska, or any other part of the Continent. They include tertiary and recent genera, such as *Acer Carpinus*, and are, therefore, not older than the miocene. They most resemble the species found in the later European tertiaries."

In considering the vast quantities of detrital matter not only filling the gutters and leads, but also covering nearly every part of the surface of the silurian rocks which underlie the basalts and lavas, we are forced to the conclusion that immense periods of time, and the persistent action of forces probably far exceeding any of those now operating in the same localities, are involved in the results which we see at such places as Ballaarat; and yet how insignificant are the changes made, how slightly are the physical features altered, as compared with what was effected in more remote periods—as for instance during the period when the secondary rocks were deposited over extensive areas, only to be again carried away.

At the risk of saying much that will be considered trite by the geologist and by those who have made physical geography their study, I will offer some remarks on the

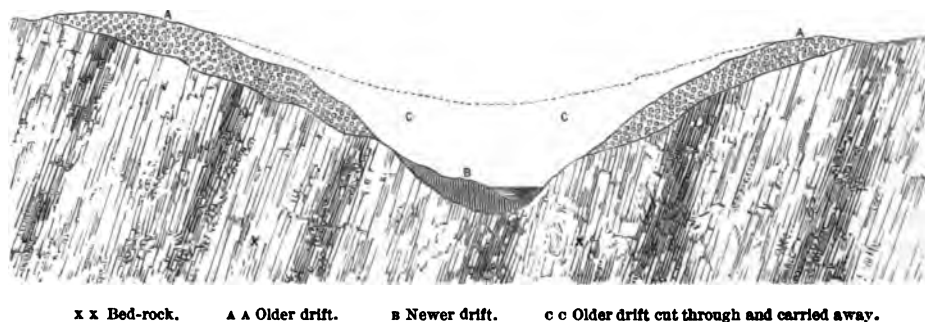
action of water, as observed in modern streams, so that the modes of deposition of some of the alluvia found on the goldfields may be more easily understood.

Whether the auriferous drifts, clays, and detritus are exposed on the surface or covered by basalt, or by quite recent sedimentary deposits, they present, as far as is known at present, everywhere the same features. In other words, if the basalt or superincumbent strata were removed, the underlying drifts and the ranges of clay-slates and mudstones would not differ in the mode of distribution or occurrence from those which are not so covered.

The action of the atmosphere, of rain and wind, of the sun, of dew, is to wear away and to make ready for removal by streams, large or small, even the hardest rocks. A stream once formed acts in two ways: it cuts into the rocks through which it flows, and at the same time deposits in the line of its course the heavier materials brought down from the neighboring heights. In this manner are the alluvia formed; and if the stream be strong and the clivity not excessive, and the rocks soft, a comparatively wide extent of drifts and clays, arranged nearly in the order of their specific gravities (having regard to the form of the particles), will be deposited; and these strata will gradually increase in thickness until the stream in its lower parts begins, by reason of a fall of the ground, to act energetically; scooping out for itself a deeper channel. This will in time wear back, and a new and deeper course will be cut through the alluvia and the bed-rock.

The following diagram illustrates the results of this action (Fig. 18):—

FIG. 18.



x x Bed-rock. A A Older drift. B Newer drift. c c Older drift cut through and carried away.

The stream represents the gutter of a lead, and the drifts A A the *reef-wash*. It is often supposed that the reef-wash is necessarily younger than the drift of the gutter, but it is perhaps in some instances older. It is easy to conceive that many successive layers, all different in age, may have been formed in this way; and where it is capable of proof that the stream has always been cutting for itself a deeper channel, we may assume with certainty that the upper drifts are older than those lying at lower levels.

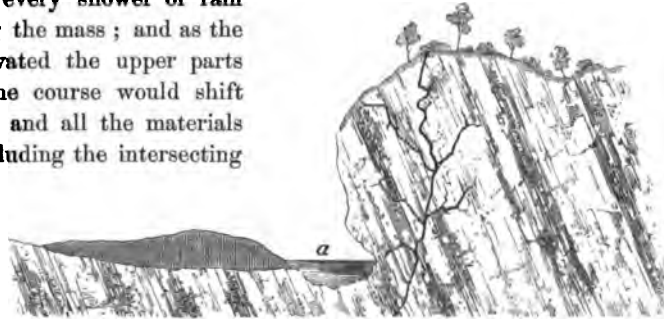
It is not often that a stream will continue to deposit materials in the direction of its course for long periods, and until its course is changed, but this sometimes happens in places where the bounding range on either side is very low. The course will silt up, and when perhaps by some fall of rock the waters are temporarily dammed back, they will find an outlet over some low part of the range into a different drainage area. Under such circumstances it is almost impossible to determine the relative ages of the deposits, more especially where the materials composing the drifts are of the same lithological character.

Streams of water, acting on highly inclined strata, composed of argillaceous

rocks and soft sandstones, effect in a short time very important alterations. They excavate new channels, and transport materials in a manner which is not observed where the rocks are in nearly horizontal layers, or hard.

The stream shown in the diagram (Fig. 19) would rapidly wear away the rock against which it strikes, and every shower of rain would assist in eroding the mass; and as the under part was excavated the upper parts would fall down. The course would shift gradually to the right, and all the materials composing the cliff, including the intersecting veins of quartz, would be broken up and carried away, to be deposited in some part of the stream-bed.

FIG. 19.

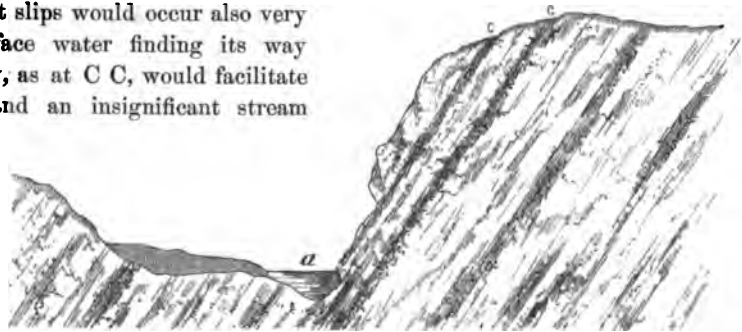


a Stream.

And as showing what is effected where diverse forces co-operate, the following sketch is instructive.

The water eroding the rocks on the right-hand side would cause masses to fall, from time to time; but slips would occur also very frequently. Surface water finding its way into layers of clay, as at C C, would facilitate this operation, and an insignificant stream would soon perceptibly alter its channel. Where clay-stones in such places form part of the strata, the layers

FIG. 20.

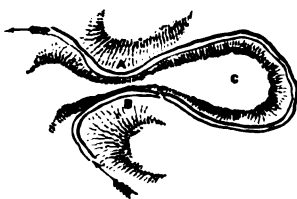


a Stream.

will not cohere, and large masses will slide into the bed of the creek or river.

Remarkable changes follow this kind of erosion, and none is more common than this:—

FIG. 21.



On examining an ordinary horse-shoe bend one sees that the stream has at different periods overflowed and denuded nearly every part of the surface of the peninsula C, which is therefore generally much lower than the adjacent country. The waters having finally cut a course as indicated in the diagram, continue to erode the sides of the range, at A and B, in the manner shown by Fig. 19, and Fig. 20, until at last the isthmus is cut through; the channel is deepened, and with the lapse of time

x 2

the old course around the peninsula is almost obliterated. The detritus in it lies at a much higher level than the more recent alluvia, and when still further changes have taken place its origin may scarcely be traceable. Small bends of this shape occur often in the alluviums of valleys subject to floods, and where, in consequence of the level character of the country, the bed of the stream is liable to be silted up.

It is commonly remarked of all the streams in this colony which run through areas occupied by basalt and silurian claystones, that they have cut a course along the line of junction of the two rocks. This is due to the softness of the argillaceous claystones. Rain-water falling on the claystone ranges would at first settle in the hollows of the line of junction—decomposition and disintegration would follow—and a channel would soon be cut in the softer rocks in the line of the depression.

In these illustrations only the simplest changes have been noted, and they are illustrated by diagrams (taken from actual sections it is true); but they are not of that precise character which some may deem necessary, and as the subject is full of interest to the miner, and if it be properly studied and understood may often prevent useless labor, and lead to the discovery of gold in new places which would ordinarily be neglected, I have asked Captain Couchman, the chief mining surveyor, to contribute such notes as he considers of value.

Having an intimate knowledge of the northern goldfields, and having made precise accurate topographical surveys of large areas, his remarks will be read with interest:—"While engaged some years ago in making a topographical survey of the Fryer's Creek goldfields, I was much struck with the extent and, generally, the shallowness of the auriferous alluviums on the summits and slopes of the clay-slate ranges, near the junction of Fryer's and Nuggety Creeks, and the regularity of their direction. Deposits of a similar kind are often found on the goldfields in outliers, capping the summits and slopes of hills, but they are usually in more detached areas, and at greater depths from the surface.

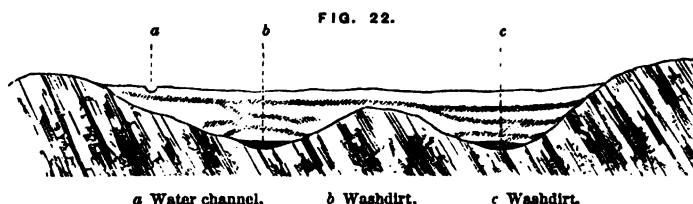
"As these hill deposits afford evidence of the great changes that have taken place in many of the drainage beds, I think they are deserving of some special notice; therefore, in offering the following remarks upon the supposed causes and effects of these changes, I desire that they may be received simply as theories formed after many years' experience of the goldfields, but from observations not specially directed to their geological character.

"As a rule auriferous alluviums are found deposited in or near the present drainage courses except in such instances as the following:—

"1. Where the old valley beds have been silted up to high levels, forming wide alluvial flats, as illustrated in the section below:—

In this case the run of gold may be found at a considerable distance from the existing water-channel, although in the same flat or valley. This

deviation seems to have been caused by the creek undergoing a constant change across the valley during the process of silting up by fluvial action, as indicated by the



alternate layers of sand, shingle, and clay, forming the deposits. Many examples of this mode of formation occur in the Maryborough mining district.

"2. It is sometimes found that old drainage beds containing alluvial deposits of gold, after being silted up to a considerable height, as described above, have been subsequently made to assume the form of hill ridges, by the erosion of newer and deeper valley beds on each side of them, as shown in the following cross section:—

The Church Hill at Castlemaine is a notable instance of this kind of made hill. It presents the appearance outwardly of an ordinary clay-slate spur; but it consists chiefly of deposits

of sand, shingle, and clay; and alluvial gold in considerable quantities has been found in it from time to time, directly under the present summit.

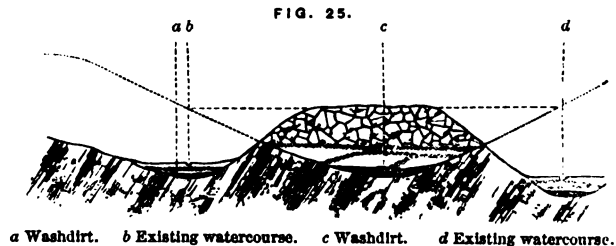
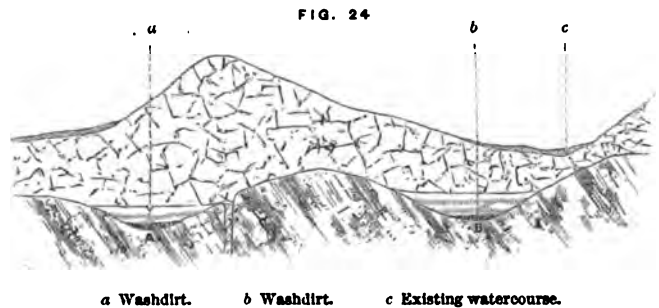
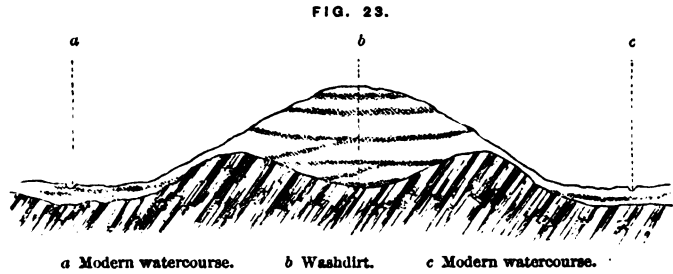
"3. Again, where the silurian claystones, &c., have been wholly or partly capped by flows of basalt, the existing watercourses or lines of drainage often differ very much in direction from the older valleys beneath them, but conform to them so far as the general direction of the drainage from the dividing ranges to the sea-coast or principal rivers is concerned. The sections hereunder are examples of this kind of change.

"Fig. 24 represents a tract of country wholly covered with basalt, upon which new lines of drainage have been worn out, conformable to the depressions and slopes of the newer surface, and under

which deep leads of gold often occur, occupying the position of the older valleys, as at A and B. The deep leads of Mount Greenock and Ballaarat are illustrations of this formation.

"Fig. 25 represents a flow of basalt originally confined to the bed of an old alluvial valley of the older sedimentary rocks, supposed to have been bounded on each side by hills, as shown by the dotted lines; but the basalt, from its indurated

character, being much more impervious to the decomposing and wearing action of the



atmospheric elements than the adjacent claystone rocks, newer valley beds at a much lower level have been eroded on each side, and the original level of the surface reduced, leaving the old valley, capped by the harder rock, to appear as a small elevated plateau; this formation may be observed in many parts of the colony where the flows of basalt have been confined to narrow channels.

"4. But reverting to the hill deposits of surfacing to which I have alluded in the first portion of this paper, they appear to me to specially illustrate the extraordinary changes that have taken place in the drainage courses formed in the older sedimentary rocks by the ordinary agencies that are now in operation. The opinion entertained by most miners to account for shallow auriferous deposits on the hills is, that they are of more recent date than the gold in the drifts of the valleys, and are the result of a later disintegration of rich quartz veins in their immediate vicinity, which has caused the gold to lodge on the slopes of the hills directly under these veins. This view may be correct with regard to those surface deposits of gold which do not lie directly upon the bed-rock; but it does not appear to be so in this instance, as they are found in immediate contact with the silurian strata, and the waterworn character of the gold and quartz detritus indicates that they have been subjected to the same friction and disturbance as the shingle and gravel drifts of the valleys. On the plans published by the Government Geological Department, these areas are noted as consisting of the newer pliocene tertiaries, while the adjacent valleys are described as being of the more recent post-pliocene epoch.

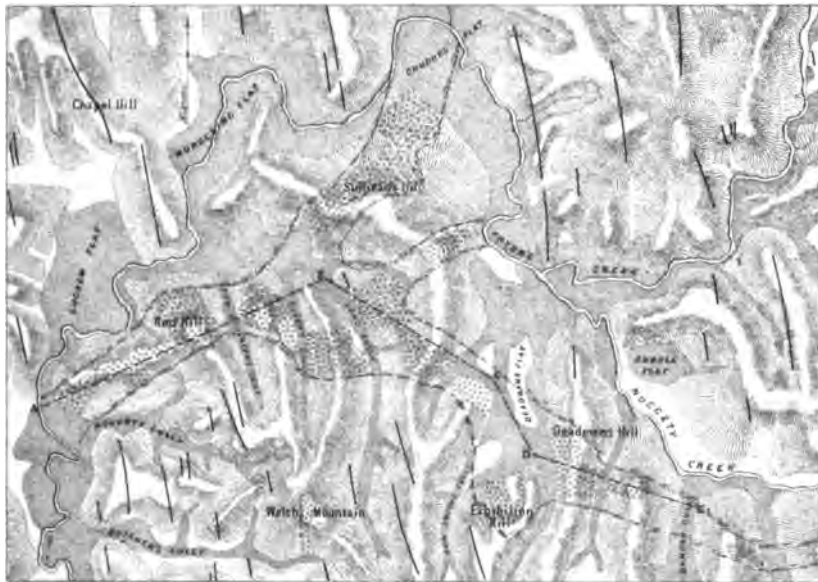
"The accompanying plan A represents the hill ridges, and a portion of the Fryer's and Nuggety Creek valleys at and near their junction, and shows the extent and position of the deposits of alluvial gold in the valleys and on the hills. It will be seen that the deposits on the latter follow regular directions, crossing the hills generally at right angles to their courses, and at one place actually following along the roof-like summit of a spur; and as their direction is at variance with the strike of the quartz veins, I think it conclusively proves that they cannot be the result of any recent disintegration of the latter, otherwise they would have been found following the courses of the auriferous veins, and trending towards the bases of the hills on either side of them.

"Therefore, admitting that these hill deposits of gold lie in the position of the older drainage beds, it appears to me extremely probable that in this instance they define the old courses of Fryer's and Nuggety Creeks, as sketched approximately by heavy dotted lines on the plan; and, if this is assumed to be the case, it is evident that great changes have taken place, not only in the position of the drainage-beds, but also in the configuration of the country, causing hills to appear where valleys formerly existed, and *vice versa*.

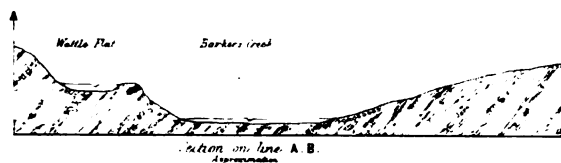
"I will now endeavour to illustrate what I conceive to have been the probable causes of these changes.

"Plan B represents an area of country including a portion of the valleys of Barker's Creek and Wattle Gully, at Castlemaine. These two valleys form a junction with the Campbell's Creek valley, about one mile below the section line A B; but on that line they occupy different levels, as shown in the section at C, the summit of the dividing ridge lying between them being only a very few feet above the Wattle Gully valley, but a considerable elevation above the valley of Barker's Creek. It will be seen that the gold deposits in the latter are situated at some distance to the eastward of the present creek, and at a higher level; and, supposing that they occupy the site of the drainage course in existence at the time of their deposition, of which I think there can be little doubt, it is evident that the valley has been gradually deepening, and wearing away to

PLAN A.



PLAN B.



- Reference.
- Auriferous Alluvium in the valleys
 - Alluvial Gold deposited on the hills
 - Quartz Veins

the westward, and that degradation and denudation have been much more active upon the slopes of the hill-range in that direction than upon the ranges on the opposite side of the valley.

"It would also appear that the small indentation or gully on the section line at the eastern side of the dividing ridge has been gradually extending back to the Wattle Gully. This general progression westward has been probably caused by the more argillaceous character of the rocks on that side, and the western underlie of the strata, which has exposed the edges of the latter to a more penetrating and directly decomposing action of frosts, rains, and heat.

"If, therefore, we can conceive this indentation to have worn back to the Wattle Gully, the whole of the drainage from the latter would be diverted into Barker's Creek; and subsequent erosion would doubtless, in course of time, form a hill, divide at E, and thus alter the direction of the existing drainage-beds, and create a remarkable change in the features of the country; and assuming the old valley of Wattle Gully to have contained deposits of alluvial gold, the slow and gradual action of fluvatile agencies upon the surface would be likely to leave the gold, from its great specific gravity, lodged on the new hills, while the lighter particles of silt formed by the disintegration of the sedimentary rocks would be washed away. In addition to the above, another change that appears to me to have been most active in its operation, has been caused by the shifting and deepening of a main drainage course, and the subsequent scouring action upon the old valleys in a lateral direction, by the cross drainage from tributary side gullies. I have already mentioned some of the agencies I suppose to have been busy in effecting the change of position of a main drainage course; but there is another to which I would direct attention, namely, the tendency of hills to wear away more rapidly in proportion to the greater inclination of their sides, by the increased scour of the drainage water upon the steeper slopes, and this action would be probably accelerated where these slopes are most exposed to the prevailing wet winds. Well, supposing the several agencies I have named, or some of them, to have been in active operation upon a valley, as shown in Fig. 26, and the valley to have deepened and changed its direction to the eastward, the following section and plan, Fig. 27 and Fig. 28, would probably represent the effect of the alteration. The newer valley would occupy a different posi-

FIG. 26.

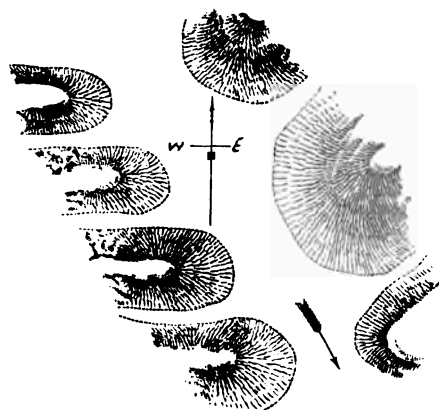
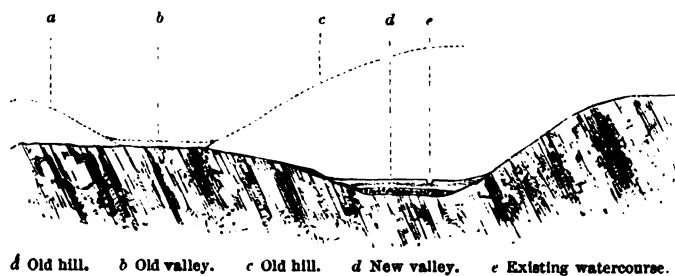


FIG. 27.



tion, and the course of the old valley would be found to cross the summits of the newly-formed hill spurs.

"I think this description will illustrate the probable mode of the occurrence of the auriferous deposits near the Fryer's and Nuggety Creeks.

"In the deep leads of Ballaarat, the alluvial gold is sometimes traced in very irregular directions. An instance of the kind occurs on the Sir William Don Lead, which at some distance from its source is said to divide—one portion of the auriferous deposits being

traced in the direction of the valley under the basalt, while the other appears to cross over a small schist ridge, and follow down into another valley; but this, and other irregularities in the direction of the alluvial deposits, may, I think, be reasonably set down to some of the causes I have explained.

"In conclusion, I would briefly recapitulate the following as the principal causes that seem to me to have been in operation, in effecting the great changes of position of many of the schistose valleys:—

"1. The greater disintegration of rocks that are more argillaceous in their composition than others in the same watershed area.

"2. The tendency of rocks to wear chiefly in the direction of the dip of the strata, through a more direct and penetrating influence of rains, and frost, and heat upon the edges that are most exposed. (See section below.)

"3. The more rapid disintegration of those hills that have the steepest inclines, owing to the rapidity of the drainage, and the increased scouring action of the rains upon their slopes.

"4. The diversion of the drainage from one valley to another of less elevation, by the erosion of a channel through the dividing ridge lying between them.

"5. The scouring action of drainage waters from tributary gullies in a lateral direction across main valleys."

Much has been said and written respecting the positions in which gold is found in the drifts. In some strata it is distributed throughout from the surface to the bed-rock—in other places it is rarely found in appreciable quantities except in the thin layer of quartz pebbles and drift immediately overlying the bed-rock. In many parts false bottoms occur. Strata of clay and sand and drift are sunk through, for sixteen or twenty feet, to the auriferous drift, which is taken out and washed. A miner—perhaps ignorant of the *usual* mode of occurrence of gold in the lead where there is this arrangement of strata—breaks through the false

FIG. 28.

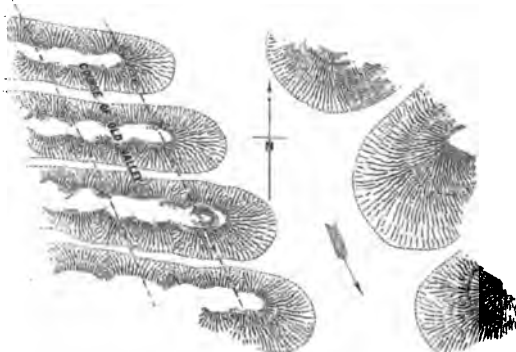
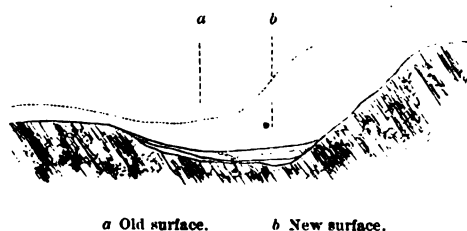


FIG. 29.



bottom, and sinks a shaft down to the true bed-rock, and finds there another auriferous layer.

How does it happen that the gold invariably finds its way to some stratum impermeable to the surface waters? That, as a rule, it lies on the bed-rock? We know that surface water—rain water—is rapidly absorbed by the thin drifts overlying the bed-rock; that, by reason of the lithological character of the underlying rocks a covering of clay is soon formed on them; that, in fact, they *puddle* themselves; and that the water derived from the surface finds its way along the course of the bed and through the drift, very much in the same way as it does in a running creek. Whatever influence, therefore, the surface waters in the drifts may have in determining the position of the particles of gold, it is certain that it does not continue to any appreciable depth in the bed-rock, and must cease as soon as an impermeable stratum is reached.

A full consideration of this circumstance leads to some inferences which perhaps are better drawn in the reports of the late Mr. Stutchbury, formerly Government Geologist in New South Wales, than by any other writer who has touched the subject.

He says:—"If we examine into the nature and cause of the several auriferous deposits, we must come to these conclusions, viz., that it is well understood, as a general principle, for the richest deposits to be at the base or bed-rock on which the alluvium rests. It must not be supposed that such an accumulation of gold occurred at one period of time, and that the thickness of soil or drift was subsequently laid on; but we can imagine that when the first flow of water descended from the higher to the lower levels, it brought, in addition to the earthy particles, gold—the size of which depended upon the particular vein or hollow in which it was originally deposited; its abrasion and reduction depending upon the distance it was removed, the force of the impelling or carrying power, and the obstacles it met with—and, having stopped in some hollow, its superior weight in the moist accompanying medium would cause its speedy gravitation, until it met with matter denser and harder than itself. The renewal of such occurrences would each time add to the quantity; and, however hard the stratum of soil had become, the gold would, from the cause before stated (viz., weight), gravitate itself: this would be a matter, in degree of time, according with circumstances. If water was retained for a period sufficient to soften the previously deposited material, its resting place would soon be arrived at; and if the water passed away immediately the gold would be left mainly upon the surface of the previous deposit, or disseminated in part through the newly deposited matter; and thus the heaviest and the smallest, having regard to form, would continue to descend, aided in the following manner:—Each piece of gold would attract around itself a moist atmosphere, which would become the medium for softening the surrounding soil (perhaps clay, baked by solar heat), thus removing the sustaining material, which establishes itself in the hollow which otherwise would have been left; so that, in the course of time, the largest accumulation must be found in the lowest parts; and, according with time and circumstances, it is possible, and even probable, that several strata of gold may be found, independent of a considerable quantity pervading the whole mass, time and constantly accruing deposits not allowing the whole affair to have settled itself.

"Again, the stream of auriferous matter may be diverted from its previous course, either for a time, and have recurred, or by the intervention or intrusion of some elevated ridge, or by the formation of a more direct course or deeper gully."

These remarks may serve to explain the occurrence of large nuggets in the sands overlying the ordinary auriferous drifts.

On all the maps of the deep leads one sees delineated the course of the *gutter*—the bed of the main channel—and though it is of the highest importance to the miner to lay down this with all accuracy practicable, it might mislead if it were not stated that this gives but an imperfect idea of the distribution of the gold-bearing alluvia. Some of the leads and gutters are not auriferous—or contain gold in such small quantities as not to be worth exploring—and consequently they do not appear on the maps. The width of the alluvia, too, greatly exceeds that of the gutter; and, in drawing conclusions from what one sees on maps of leads, it is right to bear in mind—to a proper understanding of them—that they have to be corrected, as it were, by comparison with maps of clay-slate country, where the bed-rocks and the alluvia are fully exposed, and where their several boundaries can be accurately defined. It is probable that we shall never see a complete plan of any part of the under surface of such country as we find at Ballaarat, because the miners, even if there was always an inducement, can never fully explore the whole of it.

That we get a fair view of it, and enough to satisfy the mind that it differs in no respect from those areas which are not covered by basalt, is all that can be said.

Much surprise has been caused by the finding in the alluvium in small gullies, where the watercourse even in wet weather is insignificant, of large masses of quartz and other rocks more or less rounded, which it is plain the modern stream, under ordinary conditions, could not move. These have been worn and transported, in all probability, by floods, which would occur when any fall of rock took place, in some such manner as that suggested by Figures 19 and 20. The waters temporarily dammed back, and then suddenly let loose through some newly excavated channel, would have force sufficient to bear to considerable distances, and to abrade, masses of rock which the stream, in its ordinary state, could not have-transported. Again, it is obvious, from the descriptions given by Captain Couchman, that the detrital matter in some gullies has been derived from drainage areas now quite unconnected with them.

All these descriptions and suggestions may appear trivial to those who are not practically acquainted with gold mining, or who have never turned their attention to geological investigations, but they are connected with problems which mining managers have very often to solve, or fail altogether in the work they take in hand; and geologists find in these subjects as many interesting and difficult questions as in any branch of the science.

When a lead is struck, it is often very difficult to say, until some considerable length of it is explored, in what manner it is connected with other leads in the vicinity, and much litigation has followed the uncertainty which in such cases prevails. Perhaps the safest guides in determining the matter—short of actual exploration—is the character of the detrital matter in the gutter, and the flow of the water; but neither is an infallible indication. A little consideration of the phenomena involved is sufficient to convince one that the color, lithological character, and even the mode of occurrence of the layers, may be altogether different in different parts of the same lead. The detrital matter derived from a tributary cutting through bed-rocks of dark schists will alter the color of the washdirt for a long distance below the junction with the main lead, which for the length of its course up to the point of junction may have traversed only white and pale yellow mudstones. Water, too, may be conveyed by a tributary into the main lead in great quantities, and its character may in this respect be changed so as to give rise to serious mistakes. It thus happens that, in the event of a dispute arising, the evidence of conscientious

and skilled witnesses is never accepted as conclusive, though in general much weight is no doubt attached to it, because, as a rule, the principles which guide the witnesses are sound and reliable. If we could collect the main points of such evidence (and it is given every day), an immense accession to our knowledge would be the result. Not, perhaps, in any part of the world could we find amongst lawyers so much information on difficult questions in practical geology and mining as is evinced in the mining courts of this colony. In the decrees and judgments the geologist finds abundant matter for thought. There is so much clearness of perception and accurate knowledge in regard to subjects which elsewhere do not generally occupy the attention of gentlemen severely trained to other pursuits, as to cause surprise. Many, indeed, who are accounted sound geologists, would, in dealing with the same subjects, infallibly fall short of that degree of knowledge which is possessed by some of those who have been called to the high offices of the law.

The River Yarrowee or Leigh, on the sources of which are situate the goldfields of Ballaarat, takes its rise on the southern slopes of the Main Spur or Coast Range. On the north are the sources of the River Loddon; on the east, those of the Moorabool; and on the west, those of the Burrambeet Creek. In many places near the heads of the streams, the lands dividing the Yarrowee from the Moorabool are very low and level, and in times of flood it is not easy to determine the areas of drainage. There are numerous swamps, and the lines of demarcation are faint, and have been undoubtedly often obliterated, and new channels of drainage have been made by the operations of Nature. Many of the swamps, during very heavy rains, would discharge their waters into both rivers, and in moderately wet seasons a man working for a few hours with a spade could easily alter, in a slight degree, the systems of drainage. The rocks in these places are recent basalt, covering drifts which lie immediately on the upturned edges of palæozoic rocks. If all the basalt and the older drifts were taken away, and the drainage areas restored to the condition they were in before the drifts were deposited and the basalt was erupted, and if a map were prepared of these areas, it would differ in many respects from the existing charts. The boundary lines of the drainage areas which we see now on the surface are not coincident with those of former times; and it is probable that the Main Spur itself, now a tolerably well defined watershed, followed a somewhat different course at the time when the older gold-drifts were deposited.

In all parts of the colony where the miners have explored the drifts, it has been observed that the form of the surface of the palæozoic rocks has determined the existing main channels of drainage. The recent drifts and flows of basaltic lava have modified the valleys, and in many places varied the course of the streams; but the main features, as sculptured by the aqueous agencies which operated immediately previous to and during the deposition of the drifts, remain, and are to be traced, though not without difficulty.

Regarding the existing natural undisturbed contour of the country, the gold workings at Ballaarat may be said to lie in two drainage areas. The first is Burrambeet Creek, whose sources are found in the western slopes of a low range coming from the Main Spur, and the second is the River Yarrowee or Leigh, the upper tributaries of which are shown on the map which accompanies this paper.

But the original surface of the country has been altered by overflows of basaltic lava, and subsequently by the action of atmospheric forces. After the old valleys, sculptured in the palæozoic rocks, were filled with volcanic lavas, which obstructed streams, formed lakes, and diverted the storm-waters into new channels, rain, weather,

and wind, operating through long periods, modified the new surface. Streams changed their courses again and again; newly-formed lakes burst through their banks; and ranges and temporary watersheds were destroyed.

It is now no longer possible, without expensive explorations, to delineate on a map the course of the ancient streams.

The mining operations at Ballarat have solved some of the difficulties. It is known that a main lead, receiving numerous tributaries, must of necessity trend towards Lake Burrambeet; that the Inkerman Lead, lying in a separate drainage area, must for a considerable distance be independent of this; and that the Golden Point Lead, in another drainage area, probably follows the line of the River Yarrowee.

The Burrambeet drainage area, in its upper part, is separated from the Inkerman and Golden Point Leads by ascertained lines of schistose ranges; but when we attempt to follow any of the leads into the deeper ground, there are many difficulties in the way. Though the schistose ranges are marked out with some degree of exactness by the appearances on the surfaces and from boring operations, there may be gaps in them through which the leads trend.

It is not known what course the Inkerman Lead takes; whether it trends towards a great depression answering to the modern depression known as Lake Wendouree (a mere swamp), or takes a southerly and easterly course and joins the Golden Point Lead, or follows the old channels in the schist and forms a junction with Burrambeet Creek, or follows a course independent of the creek and falls into the drifts below Lake Burrambeet, is yet a matter of conjecture.

Looking at the structure of the country and the distribution of the rocks, it is perhaps more reasonable to suppose that it is a tributary of the Golden Point than that it is lost in an old lake, or that it follows a westerly course under the basalt towards Burrambeet. If we knew the levels of the bed-rock towards the west, or more of the under-surface in the neighborhood of Wendouree, it would be possible to settle the question.

The Inkerman Lead has but a small drainage area, and in this respect differs from Golden Point Lead.

The map and sections of the goldfields of Ballarat, which accompany this paper, show the trend of the leads and the general character of the country with sufficient distinctness. They have been reduced from a large plan prepared by Mr. Robert Davidson, for the Exhibition in Dublin, and from careful sections made by Mr. Davidson and Mr. Thomas Cowan.* The areas covered by basalt and granite, and the

* Since the map was first prepared, and during the progress of this work, Mr. Thomas Cowan has made many important additions to the map and sections; and another map of the country adjacent to and immediately south of this portion of the Ballarat goldfield has been constructed to illustrate Mr. Wood's description of the leads in the vicinity of Learmonth's Pre-emptive Right. It will be found in the Appendices.

It is necessary to abstain from giving strong opinions as to the probable course of any of the leads; because such opinions, though reasonable and highly probable, may nevertheless be ill-founded, and if relied on injurious to the interests of companies, having, what they conceive to be, certain prospects of striking some well-known gutter. It is preferable that the reader should form his own conclusions from the information conveyed by the maps and sections. But when hints are afforded by a disinterested person, it is right to bestow attention on them.

Respecting the additions made to the map of Ballarat, Mr. Cowan says:—"The reef-wash in the claim of the Hand and Band Company, forms itself into a deep run of ground at point W on



quartz reefs, whether out-cropping or under the basalt, are indicated by signs, and the course of the leads or deep ground by dots; but all the palæozoic hills are covered with thin alluviums, varying in depth from a few inches to several feet, which are not indicated on the map. It was not designed to be a geological map, but strictly a map for the guidance of miners.

On examining this chart, it is seen that the Golden Point Lead receives numerous tributaries, and its course plainly indicates that it was at one time the main channel of drainage.

It is separated from the Inkerman Lead by a low range of palæozoic hills underlying the basalt, which may be traced up to Soldier's Hill, and thence northerly and north-easterly towards the Main Spur. On the east, there is a range running north and south, and nearly parallel to the first—named Whitehorse Range—which at one time—before the Yarrowee excavated its channel—was connected with Black Hill, and still further to the east there is another range nearly parallel to the Whitehorse Range.

Besides receiving all the gullies from the north within its basin, it is joined at the wide area known as the Golden Point Diggings by the Bakery Hill Lead, the Old Gravel Pits Lead, Specimen Gully, the Eureka Lead, the Red Streak Lead, and the One-eye, and all its tributaries.

Near the Golden Point Diggings the drift is followed under the basalt, and the Golden Point Lead may be traced southerly in a line rudely parallel to the River Yarrowee. In its course it receives, from the eastward, Nightingale Lead, Malakoff, Milkmaid's, Redan, Miner's Right, and Woolshed; and all the leads coming from the eastern range and crossing the line of the bed of the Yarrowee, flow into the old main channel by whatever name it may be called. The leads falling into it from the westward, as far as is known at present, are not important, and for some distance southwards from the Gravel Pits Lead, must necessarily belong to very small drainage areas. Still further southward they will be found to be longer and probably richer.

Regarding only the existing surface, we find, as already stated, but two drainage areas; that of the Yarrowee River, and that of Burrambeet Creek. The waters flowing in the upper tributaries of the Inkerman Lead change their course as they approach the basalt and fall into the Yarrowee, which received also, before the natural surface was altered, the overflow of Wendouree. But when we follow the drifts, and not the existing watercourses, it is seen that the Inkerman Lead trends towards Wendouree. It is not probable—it would be wrong to say not possible—that any lake

plan; thence the lead runs through the reef-wash in a southerly direction as far as point X, the furthest point as yet worked. At point W the lead is 290 feet in depth, and at point X 393 feet. A tributary runs into this lead at Y, from point Z, and at this point the depth of the bottom of the gutter is 260 feet. The course of the Golden Point Lead immediately south of the Band of Hope No. 3 shaft, appears to be divided into two portions: one portion passing to the west, and the other round the east side; and the two portions unite at U. It is supposed by some persons that the Golden Point Gutter runs out to the west, immediately south of this junction at V; but my own opinion is that it passes down to the south. At point V, it is probable that the portion of ground worked to the west is a tributary of the Golden Point Lead."

These are the suggestions of a practical man; and bearing in mind the interests of the companies engaged in exploring this part of the plateau, he refrains from giving them as facts which are beyond dispute. Having regard to the peculiar features everywhere presented in the deep leads, it is hardly necessary to repeat that any speculations as to the course of them (except under circumstances admitting of reasonable proof) are not entitled to much consideration.

answering to the modern depression known as Wendouree, existed in past times when the surface was composed wholly of palæozoic rocks and drifts; but all that is known of the surface of schist and claystone country, leads to the inference that no such depression could be found except under very peculiar circumstances not likely to occur in places where the rocks are rather soft, and where the action of water has been energetic.

Again, the leads traced along the course of the Burrambeet Creek may, perhaps, trend southerly, and uniting with the Suburban Lead and the Swamp Lead, finally join the Inkerman, and after receiving tributaries, make one with the Golden Point Lead.*

Even were this conjecture well founded, it should not prevent the miners from testing the ground between the Deadhorse Lead and Burrambeet, and thence northwards past Lake Learmonth and the Dividing Range towards the Bullarook Creek. In every part of this large area the same under surface as is found at Ballaarat will present itself, and what is known of the character of the reefs which crop out, wherever an island of palæozoic rock protrudes through the basalt, makes it certain that the drifts will be rich.

Referring again to the map, it is seen that the palæozoic ranges show everywhere numerous quartz reefs. One line of reefs follows the range which divides the Inkerman from the Golden Point Lead, the second follows the course of the Whitehorse Range, and the third that of the most eastern range shown on the map.

The palæozoic rocks have been largely denuded in past times, and the intersecting quartz reefs have been made to yield the gold enclosed in them, which, by reason of its specific gravity, bears a larger proportion to the quartz drift in which it is now found than it did to the mass of quartz with which it was originally associated.

Nature herself has broken out the quartz, crushed it, extracted the gold, and laid it by in easily explored drifts for man to recover; and has done this on a scale so gigantic that the mind insensibly seeks to find out the causes, to measure the vast periods of time during which they operated, and to estimate the changes which the operations have produced since the cap of the first reef was broken.

At the points where the leads intersect reefs the washdirt is usually much richer

* Mr. Wheeldon—an experienced mining manager at Ballaarat, who has the control of some of the largest works on that goldfield—inform me that a range of schistose rocks has been traced from a point near the south-western angle of Winter's Pre-emptive Section to Sago Hill, and thence to a point within a short distance of Lake Burrambeet; but the line is not continuous throughout. East of Lake Burrambeet, and near the swamp where Smythe's Creek takes its rise, there is a layer of basalt. North of the swamp, and south of Burrambeet Creek, there is another palæozoic range, on the surface of which a quartz reef has been found. This brings the leads within a definite area. Is it probable that the leads trending from the north towards Lake Wendouree unite with the Inkerman, and that the main lead formed by these trends towards Burrambeet? Does the Golden Point Lead join the Durham Lead, or does it, also, take a course westwards towards the great lake? And is the main Haddon Lead (described in another part of this paper) only a feeder of the drifts lying beneath the same great depression?

These questions will, ultimately, be set at rest; but as a safe rule we may conclude that the lines of the main streams of the under surface will not depart far from the existing main streams. The overlying basalts are not anywhere *very* thick; and though sufficient to alter, beyond conjecture, the course of tributaries, they are insufficient to vary, to any great extent, the lines of main watercourses. Burrambeet is 202 feet below Wendouree, and it is certain that there, at any rate, is a vast depression in the ancient surface of the palæozoic rocks towards which numerous streams would trend. As to its outlet in times anterior to the volcanic outbursts we know nothing.

for some distance below the point of intersection; but rich patches occur, also, where there are no reefs discoverable. The lead was once a watercourse, and it may have cut through older rich alluvial deposits which would have increased to a greater degree than the reefs *in situ* the proportion of gold in the *detritus*.

Mr. Harrie Wood has been at some pains to obtain accurate information from mining managers and others as to the probable course of the Main Lead, at Ballarat, and he has furnished a plan showing approximately the course of it.

North of the northern boundary of Winter's Pre-emptive Section it has a course about seventy chains west of the River Yarrowee; thence southwards to Learmonth's Pre-emptive Section—a distance of four miles—the direction of it is obscure. South of Learmonth's block it follows closely the bed of the modern stream for a distance of nearly eleven miles, and beyond this point it has not yet been traced.

From its source, to the most southern point yet explored, it extends southwards, without reckoning the bends, for nearly twenty-five miles; and, as it receives tributaries throughout its course, a vast field is open to the enterprize of the miner.

About eighty chains north-west of the junction of Williamson's Creek with the River Yarrowee, the shaft of the Manchester Company has cut the strata described in the following section:—

	Feet.	In.
Clay (including surface soil) - - - - -	45	0
Basaltic rock - - - - -	127	0
Bed-rock (silurian strata) - - - - -	94	0
Total depth - - - - -	266	0

The shaft is sunk at a distance of 420 feet from the gutter, which is 226 feet below the natural surface. The width of the auriferous drift, at the point intersected by the drive from the shaft, is 100 feet. The company commenced operations on the 26th January, 1863, and stopped the works on the 27th May, 1867. They worked out about 1,000 feet of the gutter, and got 528 ozs. 11 dwts. 12 grs. of gold. The bed-rock is very hard, and the washdirt is in some places so close to the bed-rock that only four inches are available. The drift is rich, but the expense of getting it out is, of course, great.

Further to the north, the Duke of Cornwall Company struck the gutter on the 1st January, 1865. It was found at a depth of 263 feet 6 inches from the surface, and is from 60 to 100 feet in width. The height of the washdirt is four feet, and about 3,200 feet of it have yielded 5,000 ozs. of gold. The section of their shaft is thus given:—

	Feet.	In.
Basaltic rock (including surface soil) - - - - -	35	0
Red clay - - - - -	7	0
Basaltic rock - - - - -	113	6
Grey clay - - - - -	9	0
Drift, gravel, and sand - - - - -	6	0
Basaltic rock - - - - -	89	0
Washdirt - - - - -	4	0
Total depth to bed-rock - - - - -	263	6

The South Grenville Company struck what is believed to be the main gutter, and

a tributary ; but it does not appear that either was followed to any considerable distance. The gutter was found to be 240 feet, and the tributary lead 154 feet, below the surface.

On examining the map and the records of the companies who have sunk shafts along the course of the River Yarrowee, south of Learmonth's Pre-emptive Right, it would appear reasonable to suppose that the main lead has been struck in those places where rich washdirt has been found ; but, probable as it seems, it is by no means certain. The character of the gutters which have been opened towards the south differs very much from that found north of Winter's Section ; and it is possible that a wider and a richer lead, an extension of the Golden Point Lead, will be found lying more to the west of the Yarrowee. Small drainage areas on the surface of the basalt do not (as already shown) correspond in their configuration to what is found underneath ; and it is to be regretted that so little information is obtainable respecting the depth of the bed-rock between the river and the leads which trend towards Korangamite and Burrambeet.

This suggestion may appear an unreasonable one to those who have gained experience on the Durham Lead, and who may have convinced themselves that they have been exploring the main channel, but it is nevertheless worthy of consideration. That the main lead follows the course of the Yarrowee is almost certain, but it is not so certain that it follows it as closely as recent explorations would suggest.

The miners at Ballarat very naturally are anxious to know something of the character of the main lead towards the south. Some persons believe that it must necessarily become richer the further it extends ; and others on the contrary are of opinion that at any considerable distance from its sources it must be so poor as to be unworthy of the miners' attention.

No information beyond that contributed by miners who have worked the gutter or its tributaries is of any value for practical purposes ; but it may not be out of place to offer some suggestions.

The River Yarrowee, below Williamson's Creek, passes wholly through basalt, except at one point, about seven miles below the junction with Williamson's Creek, where it cuts a small projecting mass of granite. We know nothing of the character of the underlying rocks until we meet the southern limits of the basalt ; and it depends altogether upon these whether the lead be rich or poor. If it cuts a course through palæozoic rocks and auriferous quartz reefs, the washdirt will not differ much from that which is found towards the north, unless it receives important tributaries flowing over tertiaries or other rocks, sufficient to throw into the main lead large masses of drifts and sands containing but little gold, or gold in such minute particles as not to be recoverable by processes now in use.

But it may intersect in some places, for anything we know, thin patches of carboniferous rocks ; sufficient to deteriorate the quality of the drifts for a long distance. The only method of getting information sufficient for the guidance of the prospector, is by putting down bores at various points between the ascertained lines of the palæozoic ranges, and fixing with all possible accuracy the levels of the bed-rock. By comparing these with one another, it would be easy to project on a map the line of deep ground ; and having found that, it would rest with the miner to determine whether or not the gutter lying in it was worth working. Properly conducted, the boring operations would give information even on this point not altogether worthless.

This plan has been followed to some extent in small areas ; but no comprehensive examination has yet been made of any large tract, mainly because the bye-laws

(wisely conceived at first, and fairly drawn and suited to the wants of the time) are now in their operation restrictive, and have a tendency to limit the views of the mining capitalists. They are, so to speak, so many checks on mining enterprize; and until the miners emancipate themselves from what is now a pernicious control, much of the wealth of the country must lie dormant for many years.

The extensive mining operations at Ballaarat, whereby hundreds of acres have been explored, from the surface to the bed-rock, have been conducted solely with a view to profit; and when we come to examine the records—the papers, maps, and sections kept by the officers employed—they are found to be deficient in many important details. This is due partly to the careless haste of the explorers. No accurate records of sections were generally kept by them. It has always been difficult to get trustworthy sections. The mining managers in early times kept such information as they gained for their own use; and naturally hesitated to give it to the public, because it might have been used to the injury of their interests.

Respecting even the magnificent enterprizes on the western plateau, we can get no sufficient account of the rock and drifts sunk through. It is commonly believed that there are three and in some places four distinct layers of basalt overlying the leads; and many sections can be produced showing how these occur and the thickness of each of them. That three and even four layers of rock have been cut through is beyond doubt; but it is not certain that in all places they are separate, and that they represent separate overflows. The stuff which lies between them is generally described as clay and gravel. If the line of separation contained a bed of water-worn gravel, it would be known at once that the layers of basalt were distinct; and that the upper was younger than the lower; but if the stuff lying between them was only white or red clay, with a few fragments of quartz, it would suggest that there had been decomposition. Basalt rapidly decomposes *in situ*, where springs of water find their way through it; and it is not improbable that some of the lines of separation have been formed in this way. Southwards, in the Whitehorse Lead, gold was discovered in the drift which lies between the first and second rocks; and judging from the depth at which it was found—between forty and sixty feet from the surface—it is probable that the stratum is of the same age as the drifts lying in the watercourses which come down from the Whitehorse Range.

The Alston and Weardale Company discovered what was called the Prospect Lead, a layer of drift containing coarse gold, under which was found the third layer of basalt. This was sunk through, and the true lead, auriferous drift resting on claystone, was at last penetrated.

At the Woolshed Lead the St. George United Company found drift between the third and fourth layers of basalt, which was sufficiently rich to pay for working. They met with a great quantity of water in driving in this stuff.

And Mr. Alfred Sayers says that a stratum of auriferous drift, about ten or twelve feet in thickness, was found overlying the basalt which covers the Nightingale Lead.

From these facts it appears to be established beyond doubt, that there were four distinct overflows of basaltic lava in the lower part of the main channel; and that periods sufficient to allow of much denudation and large accumulations of drift intervened between each of them.

There is unfortunately not much known relative to the character of the rocks lying between the layers of basalt. It is more remunerative to the miner to follow the gutters, where drives can be constructed with ease, than to make costly explorations in the hard basaltic rock; and consequently we must be content to wait for

information until the best parts of the mines are exhausted, and the companies return to the drifts which overlie the gutters. There is no doubt of their being wrought by and by, if they are as rich as they are said to be.

It is somewhat strange that we do not hear of nodules and pebbles of basalt being found in the upper drifts. The lower basaltic layers formed the beds of streams in past times, and masses of basalt must have been broken up by the weather and the waters, and the fragments deposited with the abraded quartz and claystones and sandstones in the gutters. What has become of the fragments? Have they decomposed in the beds, and have the constituents entered into new combinations?

Not until we shall have the points of eruption and the course of the several streams of basaltic lava accurately laid down, as well as the drifts arranged in chronological order, will it be possible to give more than feeble help to the miner in the work of tracing the leads and their tributaries.

As a guide to explorations under the basaltic table-land, we may safely take the phenomena presented to us in the drifts east of the River Yarrowee, which are not overlaid by basalt. There large areas are entirely covered by auriferous alluvions. The schist rocks crop out, as islands, in the midst of the drifts. The map which accompanies this paper shows only the configuration of the land, and not the geological features. If these features were accurately portrayed we could better understand the position, age, and character of the auriferous gravels which lie in the Inkerman and the Golden Point Gutters.

At Castlemaine and Bendigo, where the rocks have been greatly denuded, we find what appear to be the analogues of the deep leads of Ballaarat standing out as bosses. The modern streams have cut channels through them and near them, and the drifts lying in their beds are made up of rocks broken out of these bosses as well as out of the adjacent quartziferous strata. At such places we may discriminate three or four drifts of different ages. Can we do the same in the eastern parts of Ballaarat? Are there hills of gravel there older than the drifts which fill the gutters? And if so, what is their position geologically? The drift in the leads is supposed to be of pliocene age—are there older hills of miocene age? It is not possible to answer these questions yet. No marine fossils have been discovered in the *washdirt*; but negative evidence is not to be relied on. The mineral waters which circulate through the drifts would dissolve and carry away rapidly every particle of carbonate of lime; and the material is not suitable for retaining casts of shells.

In other parts of this paper it has been shown how great are the changes which take place by the operations of nature in claystone country. New channels are made, old channels are deepened; and drifts which at one time lay far below adjacent hills (long since swept away) are by denudation left in patches on the tops of ranges. These changes undoubtedly occurred at Ballaarat; but we are not able yet to go backward and to observe what relation the gravels in the deep leads bear to other similar but older formations, as we can go forward through the Daylesford country, and thence to Castlemaine, and see how and where the old leads have been broken up, redistributed, and formed into new beds.

The gravels in the Inkerman, Golden Point, and other leads may be younger than some of the drifts which lie on the higher slopes that bound them; * but from what

* It is difficult otherwise to explain the occurrence of the very rich drift which was found on the slopes of the bounding ridge, about thirty feet above the level of the gutter of the Malakoff Lead. It was richer than the drift in the gutter.

is seen in Ballaarat East this is not probable. The oldest beds apparently are in the lowest channels, and the younger beds overlie them, in regular order; and, looking at the slopes of the hills (whence we may form conclusions as to the *modes* of denudation), we should not expect to find older drifts on the tops and in the gaps of the dividing ridges. Outliers of older pliocene or miocene drifts, however, may be there, and they should be sought for.

As all the slopes lying to the east and south-east of the Yarrowee for a considerable distance southwards are covered with alluviums, which are still wrought with profit, and have in times past produced enormous quantities of gold, it is certain that under the western table-land similar formations will be found. Until a recent period the miners who held claims on the western plateau devoted their attention almost exclusively to the gutters—to the deeper channels—and the smaller tributaries and the thin drifts trending towards them were almost neglected. But the difficulty of finding room for all the operations contemplated on the main lines of drainage, led some of them to turn their attention to places which had been neglected; and legitimate prospecting, aided by some accidental discoveries, has opened quite a new field. Between the Golden Point Gutter and the Inkerman Lead very rich gravel has been broken into, which lies at a considerable height above the gutters. The ground appears to trend towards the south-west, and the lead—if it be a lead—has its source quite close to the ridge of palæozoic rock which forms the eastern side of the basin of the Inkerman Lead. Both sides of the main leads will in due time be thoroughly explored; and quite as rich stuff will be got there as afforded, years ago, such large profits to the discoverers of the Ballaarat goldfield.

We may judge of the character of the drift likely to be met with by what was found in Ballaarat East. There a tin-dishful of dirt taken from the surface of a hill gave as much as 168 ozs. of gold; and the shallow drifts were in many places as rich. It is true that the leads or gutters contained, as a rule, much more gold than the drifts lying on the slopes of the hills, but still these, in some places, were of enormous value.

The accompanying sections show the strata which occur as the leads are followed from the eastern slopes towards and under the basaltic lava. From Clayton Hill towards the River Yarrowee the trend of the surface of the palæozoic rock is tolerably regular, and the several layers of drift and clay can be easily traced from shaft to shaft. After passing the ridge of claystone which forms the rim of the Golden Point Gutter, we come to a section north of Mair-street and a little east of Doveton-street, which shows well the peculiarities of the lead in its upper parts.

Section N.O. runs from Golden Point across the White Flat to the Golden Point Gutter, and shows two layers of basalt. A little further southwards there are three—as exhibited by section D.E. which accompanies the plan.

These sections and the plan will enable the reader to comprehend the structure of the country; and will convey more information than any labored descriptions could do. They appear to show conclusively, as already stated, that the drift-surface of Ballaarat West will be found in all respects similar to that of Ballaarat East. If this be so, all the peculiarities of the drifts where they are exposed and easily observed should be studied by the miner, in order that any phenomena which present themselves in the leads or washes under the basalts may the more readily be explained.

It is true that some of the leads under the plateau may be older than any which occur east of the Yarrowee; but if they be older, they must necessarily be connected in regular order with the younger drifts.

The account of the mining operations on the Ballaarat leads, compiled by Mr. Harrie Wood (see Appendix A), contains more information respecting the proceedings of the mining companies and the results of their operations than has ever yet been published.

Mr. Wood has been actively engaged in mining affairs, at Ballaarat, for several years, and for a long period has occupied a position which has enabled him to get information not obtainable by others. In 1857 he was a member of the Central Committee, subsequently he acted as secretary to that committee, and in March, 1858, was appointed clerk of the mining board. He still holds that appointment, and acts also as district registrar. His accurate knowledge of the proceedings of the several companies has enabled him to furnish a statement which is of lasting value.

From his paper we gather many interesting facts respecting the yield of the washdirt both in Ballaarat East and under the basaltic plateau.

At Golden Point, when the goldfield was discovered, Brown, of Connor's party, got $4\frac{1}{2}$ ozs. of gold in two hours by washing dirt in a cradle; and from the 25th August to the 2nd October, 1851, Connor's party took 340 ozs. of gold from the surface at the same place.

In Canadian Gully 420 ozs. were taken from a claim measuring eight feet by eight feet. At the junction of the Canadian and Prince Regent Leads the Blacksmith's party took out £24,000 worth of gold from a small claim. The average yield was about 1 oz. to the American bucket; and 600 ozs. were got from one tubful of dirt. The total quantity of gold obtained from a very small area at the junction was estimated at one ton. The Prince Regent Lead was very rich—about £16,000 being the gross earnings of miners holding very small claims.

From one claim on the Red Hill Lead, measuring twelve feet by twelve feet, 1,500 ozs. were taken, and the yields in other parts in the locality were even larger.

In the Eureka Lead the average was from 1 oz. to 12 ozs. of gold to the tub.

The Italians' claim in the Gravel Pits Lead gave £2,000 per man to the first party in seven weeks.

At Gum-tree Flat one party of six men got 1,344 ozs. for ten week's work; and £24,000 worth of gold was obtained by another party in four months. At the same place a party of eight men got £20,000 in five months.

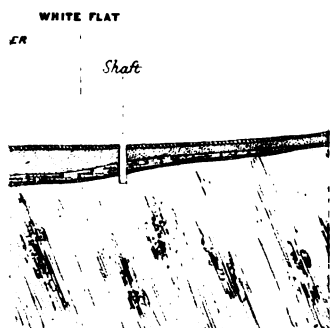
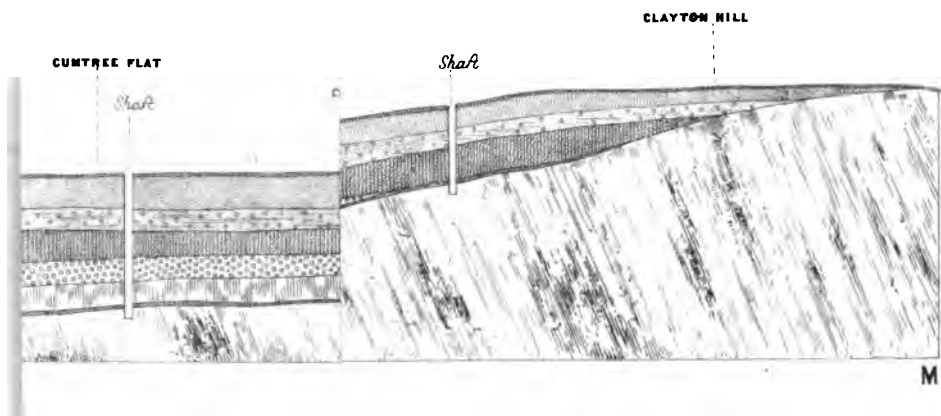
Under the table-land the claims are worked by large companies; and Mr. Wood has got together some interesting figures relative to their operations.

The following table has been compiled from information given by him. It refers to a few companies only, but is sufficient to show the enterprize of the miners and the wealth of the under surface at Ballaarat.

According to the information given in the table, it appears that forty-two companies have obtained altogether £4,305,563. And it must be borne in mind, that in most cases the areas they hold are not exhausted; many of them are now more prosperous than ever they were. As an instance of this, it may be stated that one company—the Band of Hope—washed in forty-four working days (between the 24th June and the 14th August, 1867), no less than 14,975 ozs. 17 dwts. The washdirt they were then raising was estimated to yield about 18 dwts. 3·66 grs. of gold per cubic yard.

BALL

Sections on lines L.



Sand & Gravel

 Dirt

Horia
 or Dandson Mining Depart^t Melbourne Sept 24th 1868
 Vertua

TABLE, SHOWING THE RESULTS OF THE OPERATIONS OF SOME OF THE MORE IMPORTANT MINING COMPANIES AT BALLAARAT.

Lead.	Company.	Depth of Shaft.	Length of Gutter worked.	Thickness of Washdirt.	Width of Wash.	Value of Gold obtained.	Dividends paid.	Calls made.
		Ft.	Ft.	Ft.	Ft.	£	£	£
GRAVEL PITS	Bath's - - -	250	650	*	150 to 200	17,000	*	*
	Little Engine - -	220	1,080	4 to 6	150	31,200	24,960	*
	Old Gravel Pits -	No. 1, 257	*	*	100 to 420	35,458	28,080	*
	" 2, 231							
GOLDEN POINT	Waterloo - - -	235	*	*	25 to 100	24,624	19,776	*
	Clarendon - - -	240	*	5	100	9,600	*	*
	Union - - -	247	*	2 to 5	30 to 80	13,440	*	*
	Great Eastern - -	265	*	*	*	13,440	*	*
	North Grenville -	270	*	4 to 4½	50	28,000	*	*
	Grand Junction -	292	*	*	50	11,564	9,038	*
	Homeward Bound -	310	*	3	50 to 130	11,760	*	*
	New Constitution -	No. 1, 172						
	" 2, 320		1,400	3 to 6	40	8,799	7,602	*
	Cosmopolitan - -	No. 1, 110						
	" 2, 365		*	4	300	181,040	129,784	*
	Koh-i-noor - - -	No. 1, 475	*	*	*	437,955	250,060	*
	" 2, 356							
	Band of Hope - -	No. 1, 400						
	" 2, 420		}	5 to 7	300	647,772	388,000	*
	" 3, 420							
	" 4, 325							
MALAKOFF	British - - -	304	*	*	310	50,505	49,768	*
MILKMAID'S	Burra-Burra - -	300	2,250	*	20 to 60	74,000	49,300	*
REDAN	Golden Gate a - -	302	1,100	*	*	132,000	*	*
	Great Redan Extended	350½	*	5	60 to 400	438,289	347,890	*
WOOLSEED	St. George's United	380	*	*	*	122,886	32,922	16,500
DEADHORSE	Ballaarat Extension	235	2,500	3 to 6	60	43,547	11,500	12,250
	Rose Hill - - -	260	1,300	3 to 6	100	14,800	Nil	9,975
ESSEX	Essex (Limited) -	No. 1, 80						
	" 2, 2.0		3,000	3	30 to 50	30,858	*	55,200
SWAMP	Durham - - -	425	*	2 to 3	10 to 45	2,760	*	30,000
INKERMANN	Allied Armies - -	No. 1, 150	*	3 to 30 c	200	101,350	*	*
	" 2, 210							
	Great Republic -	No. 1, 100	*	4 to 7	100 to 250	118,024	88,118	2,824
	" 2, 240							
	" 3, 278							
	Hand in Hand - -	No. 1, 285	*	5 to 8	50 to 250	63,930	36,520	*
	" 2, 410							

(a) The Band of Hope Company's shaft No. 2 is the shaft originally sunk by the Golden Gate Company, and sold by that company after their claim was worked out. The Band of Hope Company sunk the shaft to a further depth.

(b) In July, 1866, this company commenced sinking a new shaft, which has now reached a depth of 330 feet. The old shaft is abandoned.

(c) A portion of the Allied Armies Company's gutter is composed of a basin about three acres in extent. This fact is stated in order to explain the extraordinary depth of the wash.

(d) The Hand in Hand Company's No. 2 shaft has been transferred to the United Hand in Hand and Band of Hope Company, and is here called and classed as the latter company's shaft No. 2.

* Particulars not obtained.

TABLE, showing the Results of the Operations of some of the more important Mining Companies at Ballarat—continued.

Lead.	Company.	Depth of Shaft.	Length of Gutter worked.	Thickness of Washdirt.	Width of Wash.	Value of Gold obtained.	Dividends paid.	Calls made.
		Ft.	Ft.	Ft.	Ft.	£	£	£
INKERMAN—continued.	United Hand in Hand and Band of Hope	No. 1, 400	}	6	"	5,718	"	"
	" 2, 410	" 2, 410						
	" 3, 260	" 3, 260						
	Royal Saxon - -	No. 1, 345	-	4 to 6	150	106,532	45,000	49,837
	" 2, 261	" 2, 261	-	1 to 6	50			
	Southern Cross and afterwards	- 350	"	"	"	2,765	Nil	21,629
	Victoria - - -	- 350	"	"	"	2,354	Nil	13,371
	Inkerman and Durham Junction	- 410	"	3	200	14,960	Nil	23,625
SIR WILLIAM DON	Sir William Don g -	- 285	"	7	230	207,733	131,000	2,000
	Cricket Reserve -	- "	"	3 to 20	400	25,006	12,500	"
	Newington Freehold -	- 290	"	4 to 10	450	111,444	51,000	7,375
	Ballarat Freehold -	No. 1, 285	}	2 to 8	"	79,294	22,500	17,962
	" 2, 290	" 2, 290						
	Western Freehold -	- 270	"	7	400	70,231	30,000	8,125
	Southern Freehold -	- 252	"	4 to 5	"	36,674	10,425	8,750
	Park Company A -	No. 1, 330	"	"	400	10,010	Nil	Nil
	" 2, 252	" 2, 252						
FRENCHMAN'S LEAD	Nelson and Wellington	No. 1, "	"	"	100 to 300	247,131	174,029	7,127
	Working Miners -	" 2, 450	"	"	100 to 150	81,196	25,200	82,800
	Albion - - -	- 475	"	1 to 6	70 to 400	254,144	90,921	117,995
WELLINGTON -	United Red Jacket -	- 400	"	"	40	64,772	14,300	107,904
CORNER'S -	Prince of Wales -	No. 1, 387	"	up to 4 ft.	260	320,998	162,094	13,961
		" 2, "						
		" 3, 410						

(e) In September, 1866, the claim of the Hand in Hand Company was united with a portion of the Band of Hope Company's claim, and the United Hand in Hand and Band of Hope Company was formed to work it. The Band of Hope Company's shaft No. 1 became the new company's shaft No. 1.

(f) This shaft was sunk for the purpose of working a tributary of the Inkerman Lead, known as the National Lead.

(g) This shaft was formerly the Hand in Hand Company's No. 1 shaft, transferred to the Sir Wm. Don Company.

(h) This Company purchased the United Hand in Hand and Band of Hope Company's No. 3 shaft, which became the Park Company's No. 1 shaft; and they purchased the Southern Freehold Company's shaft, which now forms the Park Company's No. 2 shaft.

(i) The Wellington Lead runs through the ground, and is also worked by this company.

* Particulars not obtained.

The manager of the Cumberland, Durham, and Cornish Company made an estimate, from facts collected by him, of the gold got from the Frenchman's Lead. He found that the value of the gold obtained was about £50 per lineal foot, and that the yield from 2,566 feet in length, measuring along the gutter, was £127,729, the cost of working being £37,000.

The gutters in some places are very wide, and here and there the miners find large areas completely covered with rich drift. In Greeve's paddock, on the Inkerman Lead, where it bends, a large space, about three acres in extent, was wrought by the Allied Armies Company. They found washdirt thirty feet in thickness. It was composed of clay and gravel, and was more or less auriferous throughout.

When the leads at Ballarat were traced towards the basaltic plateau, and when it became difficult to follow the course of a lead from the indications on the surface,

the miners endeavoured to evade the obligations of the regulations under which they held their claims. In most cases the gutter or old bed of the stream was found to contain the richest washdirt, and every effort was made to get as much as possible of the gutter. Claims were marked out on a lead far in advance of the point where the gutter was opened, and the holders were consequently in doubt as to the character of the under surface of their areas. Instead of sinking a shaft to ascertain the nature of the bottom, they resorted to every contrivance to avoid labor and expenditure, and at the same time to preserve their title, waiting patiently until the lead should be followed towards the boundaries of their claim or the certainty of its taking another direction established.

The local body, charged with the duty of making regulations, was under these circumstances compelled to take action to prevent miners from holding claims which they did nothing to develop. The first step was to endeavour to compel them to sink shafts; but a little consideration and a very short experience showed that this would lead to much unprofitable expenditure. What was deemed a happy thought at this time came into the mind of one of these legislators. He suggested that areas might be granted, which should be bounded by the lines of concentric circles of different radii. This was at first opposed, but ultimately the originator, Mr. Bacon, saw his scheme adopted and perfected by Mr. James Baker, who for many years acted as the chairman of the Mining Board at Ballaarat.

The design of the local body was to give a certain length of the gutter, whatever course it might take, to each prospecting party, in order that the miners might be encouraged to employ their labor in the deep leads which were trending under the basalt.

This resulted in areas being granted, the figure and extent of which were determined, it is true, but they could not be laid off on the surface until the course of the gutter was ascertained.

The first Regulations, published in the *Government Gazette* of the 7th March, 1856, were as follows:—

“Special Regulations made by the Local Court of the District of Ballaarat, exclusively applicable to the leads known as ‘Frenchman’s’ and ‘White Flat’ Leads:—

*“First.—Extent and position of claims.—*That every party of twelve men shall be allowed thirty-four (34) feet, irrespective of width, until they have found the ‘gutter’ or ‘lead;’ but no party shall have protection for more than forty (40) feet in width upon the ascertained ‘lead’ or ‘gutter.’

*“Second.—Marking of claims.—*That all claims be marked at right angles with the supposed course of the ‘lead,’ and a wall of six (6) feet be left between each claim. Provided always that no miner or single company of miners shall have a grant of more than one claim at the same time.

*“Third.—Position of claims in case of deviation of lead.—*That in cases where the ‘gutter’ or ‘lead’ changes its course from the supposed one, the position of the original claims shall be changed accordingly, taking precedence as before, according to their number.

*“Fourth.—Claims upon cross leads.—*That in cases of cross leads—that is to say, where a lead crosses or intersects the Frenchman’s or White Flat leads—claims shall be granted upon such leads, subject to the conditions herein mentioned for the Frenchman’s and White Flat leads. The claimowners upon each lead shall have protection from the encroachments of claimowners of adjoining leads.

*“Fifth.—Registration of claims.—*That all claims be numbered consecutively, and registered with the names in full of the members of each company; also, the number

and date of the 'Miner's Right' of every shareholder, and a duplicate of such registration be given to the parties obtaining such claims.

"Sixth.—*Names of claimholders to be posted.*—That as soon as any party, or company is registered, it shall be the duty of such party or company to post the names in full of each shareholder on the most conspicuous part of their claim, where they shall remain until the claim is wrought out or abandoned.

"Seventh.—*Marking position of 'gutter' or 'lead' upon the surface.*—That as soon as the 'gutter' or 'lead' is found in any claim, the shareholders upon such claim must report the same (as hereinafter provided) forthwith, and mark its position upon the surface by fixing a flag upon the spot.

"Eighth.—*Surveyor.*—That in order that these rules be brought into effective operation, it is necessary that a competent practical miner be appointed as surveyor, whose duty it shall be to measure and mark off claims, number and register them, survey claims when the 'gutter' or 'lead' is discovered in such claims, and point out to such shareholders the spot where they must fix the flag; survey in all cases of encroachments, and perform such other duties that would legitimately come under his notice as surveyor of the leads."

These were subsequently, to some extent, modified, and further regulations were made; but the system was looked upon, generally, by the miners operating in deep ground with favor.

When Mining Boards were established, under the Act 21 Vic. No. 32, the local body at Ballarat passed a bye-law, dated the 14th May, 1858, in which the following clauses relating to the frontage system were included:—

"3. *Method of laying off claims.*—All frontage claims shall be marked off in accordance with the method indicated by the plan marked A, registered in the mining board; and when the depth of sinking on any lead has been ascertained the length of gutter to which eight (8) men shall be entitled will be according to the following classification:—

Depth of Sinking.		Length of Lead for a Claim for Eight Men.	Depth of Sinking.		Length of Lead for a Claim for Eight Men.
Exceeding.	Not Exceeding.		Exceeding.	Not Exceeding.	
Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
50	60	50	230	240	140
60	70	55	240	250	145
70	80	60	250	260	150
80	90	65	260	270	155
90	100	70	270	280	160
100	110	75	280	290	165
110	120	80	290	300	170
120	130	85	300	310	175
130	140	90	310	320	180
140	150	95	320	330	185
150	160	100	330	340	190
160	170	105	340	350	195
170	180	110	350	360	200
180	190	115	360	370	205
190	200	120	370	380	210
200	210	125	380	390	215
210	220	130	390	400	220
220	230	135	400	410	225

And in a like proportion for any greater depth of sinking.

"4. *Increase in size of claims.*—Measuring from the prospect claim in the direction in which the lead becomes deep, each claim shall increase in length one (1) foot upon the claim immediately preceding it. Example: suppose the lead to dip in a westerly direction, and the depth of the claim No. 1 west of the prospect claim to be one hundred and twenty (120) feet, then the length (according to the above classification) of lead for No. 1 claim would be eighty-five (85) feet, for No. 2 eighty-six (86) feet, No. 3 eighty-seven (87) feet, No. 4 eighty-eight (88) feet, and so on.

"5. *Decrease in size of claims.*—Measuring from the prospect claim in the direction in which the depth of sinking becomes less, each claim shall decrease in length six (6) inches on the claim immediately preceding it. Example: suppose the lead becomes shallow in an easterly direction, and the depth of the first claim east of the prospect claim to be one hundred and twenty (120) feet, then would the length of lead for No. 1 claim be (according to the above classification) eighty-five (85) feet, No. 2 eighty-four feet six inches (84 ft. 6 in.), No. 3 eighty-four (84) feet, No. 4 eighty-three feet six inches (83 ft. 6 in.), and so on until the length of claim shall have decreased to fifty (50) feet, which shall be the minimum length for eight (8) men on any frontage lead.

"6. *Datum for Measurement of lead.*—The length of gutter to which the parties registered for the first claim on either side of the prospecting claim may be entitled, shall be determined by, and be in accordance with, the depth of the prospect claim, and the increase or decrease, as the case may be, shall take place from the first claim on either side of the prospect claim.

"7. *Mode of determining depth.*—The depth of any lead (at the point where it is discovered) shall be determined by measuring from the surface to the deepest known point in the gutter within the claim in which the discovery has been made. In cases where the surface presents sudden and abrupt rises, it will be the duty of the surveyor to report upon the same to the warden, in which case the warden shall have power to order such an increase in the areas of claims as will compensate for the additional depth of sinking resulting from such sudden rise: Provided always that such increase does not interfere with the existing rights of claimowners.

"8. *Abolition of spare ground.*—The length of claims ascertained as above shall only have reference to surface measurement, and any additional length of gutter found to lie within the surface boundaries of any claim shall belong to the parties registered for the parallel in which it may occur, consequently there cannot be any spare ground upon a frontage lead.

"9. *Width of frontage claims.*—The width of claims shall vary each consecutive ten (10) claims in the following manner:—The width of the first ten (10) claims shall be a mean between the length of claim No. 1 and claim No. 10; the width of the second ten (10) claims shall be a mean between the length of claim No. 11 and claim No. 20, and so on until the width shall have arrived at two hundred (200) feet, which shall be the maximum width allowed to frontage claims.

"10. *Taking possession of frontage claims.*—No person shall be registered for frontage claims until such claims have been marked off by the surveyor, and when frontage claims have been marked off, the surveyor shall register the first applicants for shares in such claims: Provided always that such applicants are qualified in accordance with the provisions of these rules.

"14. *Discovery of the gutter.*—All parties when they have bottomed their shafts shall, within a reasonable time, put one main drive along the course of the gutter or lead to the boundaries of their claims, such drives not to exceed twelve (12)

feet in width, and as soon as the lead or gutter is found in any claim the shareholders of such claim must report the same forthwith to the surveyor.

"15. *Junction*.—When it shall appear to the surveyor that any two or more leads will form a junction, he shall report to the warden the position of such leads. Upon such information the warden may order further registration to be stayed on one or more of such leads; and should it be afterwards ascertained that there is any space left between the last claim on the lead on which the registration was stopped and the junction, the surveyor shall post a notice on his office for six days, stating the number of claims for which there is room, and on a certain day to be named in the notice he will register applicants for shares on such lead.

"16. *Name of lead after junction*.—After the junction of two or more leads, the lead after such junction shall be called by the name of that one on which the registration was not prohibited.

"17. *Registration too far*.—When claims shall have been registered too far previous to the prohibition as before provided, the number of shareholders so registered beyond the real junction shall be entitled to an equal interest with the same number of claims and shareholders on the main lead, beginning at the point at which such junction has been formed; and after the amalgamation of such parties, only the usual number of men provided for such claims shall be required to work the same, and the additional number of men added to the parties by such amalgamation shall be entitled to employ themselves as the party may think fit.

"18. *Definition of a junction*.—A junction shall be considered to have taken place when the two leads come within the breadth allowed by these regulations for one claim.

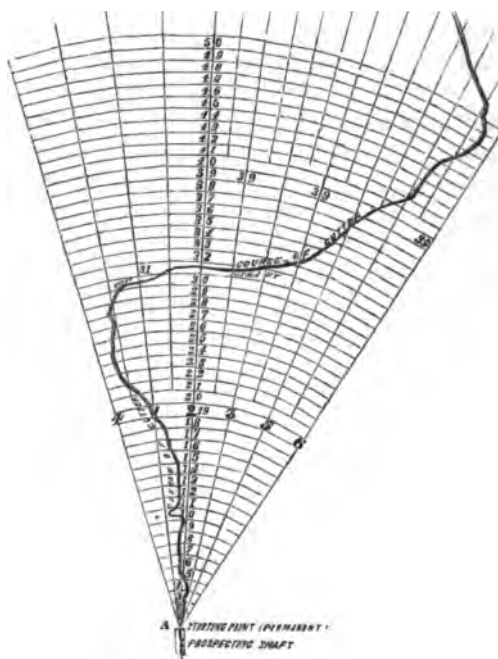
"19. *Ground lying between leads*.—When, from the convergence of two leads, the quantity of ground lying between such leads is insufficient to allow of the parties on each lead getting the full width of claim allowed by these regulations, the surveyor shall divide equally the ground lying between such leads between the parties holding claims on the leads thus converging, and the width thus determined shall be the extent of width to which such parties shall be entitled.

"20. *Party sinking on parallels*.—In the event of the shareholders of any lead complaining that the shareholders of another lead are sinking their shaft too near them, the surveyor shall have power to define what space shall be left between each shaft.

"21. *Parallels not to be sunk upon till the gutter is defined*.—No party shall be allowed to take possession of, or sink on the parallel of a party holding a frontage claim, until such time as the surveyor has declared the lead thoroughly defined in such frontage claim, and fixed all its boundaries."

Plan A referred to in the local

PLAN A.



court rule, No. 3,* of the District of Ballaarat, gazetted on the 14th of December, 1857; and also referred to in section 3 of bye-law No. 3, of the Mining Board of Ballaarat, passed by the said board on the 14th day of May, 1858, and gazetted on the 15th June, 1858.

Subsequently a clause was inserted in an amended bye-law, relative to the mode in which the boundaries of frontage claims should be determined in places where leads converged. It is as follows:—

“23. *Width of frontage claims near point of convergence.*—When from the convergence of two leads the quantity of ground between said leads near the point of junction is insufficient to allow the claimholders upon the respective leads to obtain the full width of claim allowed by this bye-law, and for which they shall have been duly registered, the ground lying between such leads shall be divided between such claimholders in accordance with the principle indicated in Schedule XIV. to this bye-law annexed:—

SCHEDULE XIV.

REFERENCE.

Lines AB and CD represent the boundaries of the claim of Richard Roe and party.

Lines EF and GH represent the original boundaries of the claim of John Doe and party.

Lines EF, RP, and PK, represent the boundaries of claim of John Doe and party after the junction is discovered.

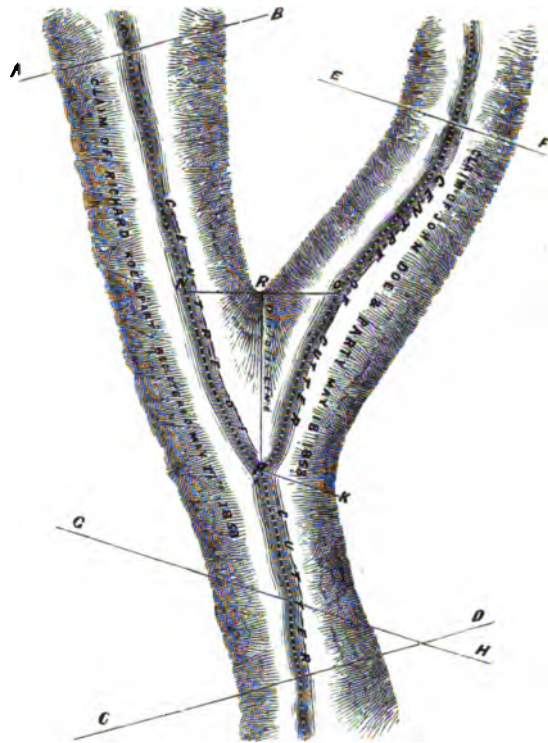
Line PK is parallel to lines EF and GH.

The bearing of the line NO is a mean of the bearing of the lines AB and EF.

Points N and O are the centres of the confluent leads.

Line RP is the dividing line or lateral boundary of the claims of Roe and party and Doe and party.

Point P is the point of confluence.”



These extracts and the diagrams sufficiently explain the rather curious and complicated system under which claims were occupied for many years at Ballaarat.

The first effect of these regulations was good. Many companies took up areas and worked them energetically, and produced large quantities of gold; but the extension of the system as applied to the main leads and their numerous tributaries, the taking up and registering of block claims within frontage claims, and the occupation by a large population of sites for residence and business purposes within registered

* The local court rule is nearly word for word, the same as the bye-law.

areas, produced at length such serious complications that every miner who was interested in the more valuable claims clamored loudly for a change—for a system under which he might get a secure tenure of the land on which he had expended his capital. He, in despair, produced a plan, showing an immense number of lines crossing one another in every direction; these lines purporting to be the boundaries of claims; and the members of the Royal Commission, before whom it was laid, were utterly at a loss to ascertain whether any company could by any possibility have any right anywhere. Except that it was formed on no system, and seemed to be unnecessarily unstudied, it might be said to bear some resemblance to the lines which would occur if two or three spiders' webs were superimposed on one another. Under the most favorable circumstances an area taken up on any lead was subject to the inchoate rights of five or six adjoining companies. And the holders of the claims did not conform to the bye-laws. It was enacted that when the holders should find the gutter, they should within a reasonable time put one main drive along the course of the gutter or lead to the boundaries of their claims, and this they neglected to do.

Such omissions, and the exceeding difficulty of interpreting the language of the bye-laws, and of separating subjects unnecessarily mixed one with the other in the same sentence, produced finally so much confusion that lawsuits innumerable followed the marking out of every claim. Hundreds of thousands of pounds sterling were expended in unprofitable litigation; and now, owing to changes in the Statutes and the bye-laws, scarcely one of the decisions, important as they were at the time, will ever be referred to.

The attention of the Legislature was from time to time directed to the peculiarities of the Frontage Bye-laws, and doubts having arisen as to the validity of them (or perhaps, to speak more correctly, no doubt being entertained as to their being *ultra vires* of the Act), a short Act was passed on the 18th September, 1860 (24 Vic., No. 111), containing amongst others the following clause:—

“1. No rule or regulation heretofore made by any local court, nor any bye-law heretofore made or hereafter to be made by any Mining Board, shall be deemed to be invalid, by reason that such rule, regulation, or bye-law may provide or declare that the lateral boundaries of any claim occupied or to be occupied for mining purposes, shall not be defined until the ‘lead’ or ‘gutter’ in any such claim, or in any claim above or below such claim, upon the lead or the gold in such lead or gutter shall be found, struck, or defined; or by reason that the position or size of the claim shall be altered upon the discovery that the actual course of a lead or gutter varies from its supposed course; or by reason that the extent of any claim or the title to the same, or to any portion of the same, shall depend upon or be varied by the discovery of a junction between two or more leads or gutters.”

On this occasion, as at all times when an appeal was made to it, the Legislature did all that was possible to give relief; but it could not cure defects which were inherent in the system, or settle disputes which generally were pursued with a virulence and a disregard of consequences rarely witnessed.

Companies fought, indeed, not so much for the land, the subject of dispute, as for victory; and the moneys of the shareholders were recklessly squandered in many cases which any man possessed of common sense and fairness could have decided in a few minutes.

The frontage system came to an end on the 7th September, 1866; and the last frontage claim was taken up by the United Extended Band of Hope Company, on the 14th July, 1866.

The rights acquired under that system remain, but the mining companies are striving earnestly to procure large areas under lease from the Crown ; and it is not too much to say that, wealthy as Ballaarat is, it would have been immeasurably more prosperous if instead of the frontage claims the local body had in the first instance granted sufficiently large areas, with well defined boundaries, to parties willing to incur and able to fulfil reasonable obligations as to the employment of labor and the investment of capital.

Recent discoveries have clearly demonstrated that the frontage system was devised under a misapprehension of the character of the under surface at Ballaarat ; but when we consider the circumstances of the time, the impossibility of gaining any hints as to the modes of occurrence of deep alluviums from even scientific men, and that there was an absolute necessity for immediate action, in order to avert an abandonment of the deeper ground by the wealthier and the more speculative among the miners, we find no room for censure ; but on the contrary, we must acknowledge a debt of gratitude to those able men who neglected profitable avocations to frame regulations under which mining could be pursued with reasonable prospects of success.

Pressed as they were by ignorant persons who seemed afraid of any one getting rich by hard labor and the investment in hazardous enterprizes of a considerable amount of capital, it would probably have been impossible for them to have passed any bye-law giving large areas in the shape of block-claims ; and as a compromise they adopted Mr. Bacon's ingenious suggestion.

The Ballaarat frontage system, with some modifications, has been adopted in other districts.

Much difficulty has been created at Ballaarat and on other goldfields by the alienation of large tracts of auriferous lands. The pre-emptive sections (generally 640 acres in extent), claimed by the pastoral licensees, were marked out in auriferous areas and purchased ; and owing to the want of knowledge of the modes of occurrence of auriferous drifts and veins, quite extensive areas have from time to time passed from the Crown into private hands.

Private lands are barriers in the way of the prospector. If the *lead* is rich, the proprietors are often exorbitant in their demands ; and if it is poor, or its course undetermined, even a moderate exaction is sufficient to scare the miner.

Frequent attempts have been made to provide for mining on private property by Legislative enactments, but up to the present time without success.* The difficulties are very great. For any public work, as for instance for a railway, a road, a reservoir,

* The following Bills have been presented at various times to the Legislature, but up to the present period no Act has been passed providing for mining on private property :—

Session 1856-7. No. 34. Mining on Private Property Bill.

A Bill to provide for equitable Mining on Lands that have passed from the Crown. (*Mr. O'Shanassy.*)

No. 35. Gold Mining on Private Lands Bill.

A Bill for Gold Mining on Private Lands. (*Mr. Haines.*)

Session 1858-9. No. 27. Gold Mining on Private Property Bill.

A Bill to remove certain legal difficulties affecting contracts and relative to Mining for Gold on Private Property. (*Mr. Ireland and Mr. Chapman.*)

Session 1859-60. No. 51. Gold Mining on Private Property.

A Bill for legalizing and regulating Gold Mining on Private Property. (*Mr. Bailey.*)

or a canal, it is clear that private interests should give way to public necessities ; but it is altogether different when it is proposed to take private lands for mining purposes. It is obvious that the opening of a lead passing through private property is not primarily so much a public as a private enterprise. The public may share indirectly in the prosperity which may make rich the mining company which takes up the claim ; but they cannot in any way directly avail themselves of the privileges which would be conferred by opening the lead unless they join in the risk. It is not so with a railway, a public road, or a system of water supply. Everybody is the better for the work, and all may directly partake of the benefits of it if they like. But when large areas are *tabooed* to the miner in the vicinity of a great goldfield, and when it is known that the avarice of the holders is the only bar to successful enterprise and the development of a great industry to which the country owes its present prosperity, it becomes a question whether the practice applied in cases where lands are required strictly for public purposes should not be extended to auriferous tracts. And those who are more immediately interested, argue that the present holders got the lands merely by accident ; that it was through ignorance of their value that they were alienated ; and that, unlike lands held by families in Europe, from generation to generation, they are not surrounded by traditions, nor in any way connected by sentiment with the speculative purchaser.*

All this is true, and will have weight in determining the issue.

It is estimated by the Mining Board of Ballarat that about 12,117 acres of private lands are held under lease by mining companies, and that of this large area only 500 acres are actually occupied or rendered unfit for other occupation by the operations of the miners ; and yet the sums paid for leases are said to amount to £410,692.

This state of things surely calls for a remedy.

The length of the leads and lodes within the private properties is estimated at $24\frac{1}{2}$ miles, and the value of the gold therein (how arrived at it is impossible to say) at £6,600,000.

There are only 1,032 miners at present employed in the mines in private property ; whereas, under the bye-laws, the same areas would, theoretically, require the employment of 5,000 men.

Session 1861-2. No. 60. Mining on Private Property Bill.

A Bill to regulate Mining on Private Property. (*Mr. Pope.*)

Session 1862-3. No. 30. Mining on Private Property Bill.

A Bill to facilitate Mining on Private Property. (*Mr. Pope and Mr. Macgregor.*)

No. 56. Mining on Private Property Bill (2).

A Bill to legalize Mining on Private Property. (*Mr. Smyth.*)

Session 1864. No. 39. Mining Laws Consolidation and Amendment Bill.

A Bill to Consolidate and Amend the Laws relating to Mining. (*Mr. Sullivan.*)

* It is well to remember, also, that the so-called proprietor holds no more than an estate in the lands. He is not, and cannot be under the laws of England, as interpreted, the absolute owner of real property. There is one estate vested in the Crown. The mixed questions of law and policy involved may at any time be rudely separated, if events should make a separation necessary ; and if the proprietor were denuded of all except his bare legal rights, he might well regret that he had forced an investigation of his real position. A ready acceptance of the facts, and a willingness to further mining enterprise, might even now make legislation unnecessary ; but it is scarcely to be hoped that wise counsels will prevail.

This question has engaged the attention of the ablest men in the community. It has been debated from time to time; and, as it is likely to assume larger proportions in the future, it is certain that it will be dealt with very soon, and in no narrow spirit. The owners of the lands will be sufficiently protected, while the enterprise of the miners will be allowed full scope. The systems which operate satisfactorily in the mother country in regard to copyholds might be introduced here, with advantage both to the miner and the landowner.

The wealth of the deep *lead* mines at Ballaarat, the facilities afforded the public of sharing in the prosperity of the miners, the ease and rapidity with which interests in mining properties are transferred or encumbered, and the great and constant desire amongst a number of persons everywhere to partake, to however small an extent, of the pleasures of gambling, have all combined to induce from time to time a spirit of speculation, which, while it has often proved ruinous to individuals, has not always conduced to the prosperity of the district.

Directors of mining companies have been led too often to look for guidance in their operations rather to the sharemarket than to the mine itself. Companies have been plunged into debt, in order that dividends might be paid; gold, or washdirt, has been allowed to accumulate for weeks, so that a considerable quantity of the precious metal might be cleaned off at some critical period in the sharemarket; and shares have been depressed by the circulation of false reports respecting the condition of the mine, for the purpose of enabling a few designing persons to get possession of the property.

It is not necessary to say that a great deal of sound speculation, good and honest management, and wise enterprise are yet characteristic of Ballaarat. The larger mines are conducted generally on right principles, and managed by gentlemen in whom the public have confidence. When we consider that the estimated value of the claims within a small radius is £1,803,190 and that new works of immense extent are projected every day, we are safe in concluding that, as regards the conduct of the mines generally, there is no room for animadversion. But this state of things will not long continue, unless strong measures of repression be used in every case where there is a deliberate departure from honest principles.

People are unduly sensitive in regard to mining adventures. They are easily scared; and mistakes and misconduct in the management of one mine may result in the total neglect of a rich district. Some of the best reefs in the colony are now lying unworked, solely because of the unfair practices of dishonest speculators. They have terrified the capitalist, and he has gone elsewhere with his money.

The Smythesdale leads are situate on the streams which run into Lake Korangamite; but all the leads do not trend towards the lake. The principal lead—known by several names—conforms generally to the course of Smythe's Creek, and, it may be presumed, will ultimately be traced into the lake; but the source of the lead and the source of the creek are separate from one another.

Smythe's Creek has its source in a swamp which lies about three miles to the south-east of Lake Burrambeet, and it runs southwards for nearly three miles, through and over basalt, to McLachlan's Pre-emptive Section, where it enters schistose country. The boundary of the basalt at this place seems to conform to the old dividing range (which it obliterates), and we find one lead trending thence northwards for a short distance towards Haddon, and another—the main lead—following nearly the course of Smythe's Creek southwards. In other words, there is a lead traceable for some distance in a direction contrary to the flow of the modern stream. It is

scarcely possible to make this plain to the reader, without a map or diagram; but perhaps it is sufficient to say, that while the modern stream flows uninterruptedly southwards the old drift which underlies the basalt unmistakably trends northwards—in a contrary direction.

The lead which trends northwards from the pre-emptive section is, however, only a tributary lead. The main lead runs westwards, towards Carngham, and receives from the eastern ranges, near Sago Hill Diggings, numerous tributaries, and probably also from the ranges towards the north other smaller feeders. The bores which have been put down in the claims of the Amazon Company, the Gulf Stream Company, and others, prove satisfactorily that a main stream once flowed westwards, and that its course conforms in no manner to the configuration of the ground as it now presents itself. Whether this main lead trends towards Lake Burrambeet, or follows the course of the stream which flows towards Mount Emu Creek; whether it is continuous throughout, or broken by denudation; or whether it is auriferous or not throughout its course, can only be conjectured. But that it presents a feature of great interest, both to the miner and the geologist, is unquestionable, and each will watch the operations of the explorer in this part of the Ballarat District with more than common attention.

Mr. John Lynch, the mining surveyor of the division, who is not inexperienced in geological investigations, has made careful observations, especially for this work, and the following information has been compiled from the papers and plans furnished by him:—

Between McLachlan's Pre-emptive Section and Warren's Lead (the Main Smythesdale Lead), for a distance of three miles, the ground is shallow. A wide expanse of washdirt covers the entire valley between these places. Since 1853 mining operations over the whole of the flat have not ceased; and even now the Chinese make a living by turning over the old ground. The depth of sinking varies from ten to seventy feet, the strata being composed entirely of clays and sandy and pebbly drifts. The whole area forms a natural division between the Haddon mines and the Main Lead. From McLachlan's Pre-emptive Section the leads get deeper towards the north and north-west. There are two block claims and a leasehold at present being worked at Haddon. The leasehold and one of the blocks are getting gold, and the other block is sinking through basaltic rock, of which there are about seventy feet to be passed through. A good many claims were taken up in the Haddon District about two years ago, but they have remained untouched since. Now that mining operations are being carried on more energetically it is probable that these claims may be properly wrought, and there is a belief that some of them will be very rich.

West of Smythe's Creek there is a range composed of silurian rocks, which separates the Main Lead from a system of leads, having their sources in what are called by the miners the Hard Hills.

The Snake Valley Lead trends northwards from the Hard Hills towards Carngham; and the Happy Valley Lead, and its tributaries, trend from the same hills southwards and eastwards towards the Main Smythesdale Lead.

Before proceeding to describe the leads it is proper to give some account of the Hard Hills, and the drifts which occur near McLachlan's Pre-emptive Section. I have not yet had an opportunity of examining the Smythesdale District; but I have carefully gone over the reports, plans, and sections which have been furnished by the mining surveyor; and, on comparing these with notes and sections made on other goldfields, I became convinced that the drifts at the Hard Hills were older than the

Smythesdale leads. And in order that additional information might be obtained on this point, and in regard to their character generally, I desired Mr. Lynch to furnish me with such facts as he might be possessed of. Though well acquainted with them, he instituted fresh researches, and has given a very interesting account of them.

He says:—"For the purpose of being able to form an opinion as reliable as possible, I went over the locality, and collected specimens of the bottom rock, both on the Hard Hills and for three miles further down the lead, as far as Bottle Hill. Now, as regards the Hard Hills:—

"1st. They are not covered with basalt. The basalt first appears at the base of the hill next Carngham, and is confined to the lead which at that place begins to form. It is at first but a thin capping, but gets thicker and more solid farther on. The basalt, I believe, has issued from the 'Green Hill,' about three miles north of the Hard Hills. There is no basalt lying near: what exists of it is confined to the old channels, as described.

"2nd. The depth of sinking on the Hard Hills varies from ten to sixty feet; the former being about the shallowest at the summit, and the latter the deepest at the base, where the Snake Valley leads begin to form. The drifts are composed, in some places, of grey, brown, and yellowish sands and drifts—here and there loose, and in other parts coherent and even cemented. These drifts are interstratified with stiff brown or reddish clays. The washdirt is chiefly composed of clays; and the bottom is strewn all over with boulders of quartz, some of which are of considerable size. In some places the washdirt—both pipeclay and boulders—is easily worked; whilst in other places, by reason of the admixture of ferruginous sands, it is hard and not easily wrought. All along the regular lead, throughout the Snake Valley Flat, the washdirt is loose. The bed-rock at the Hard Hills is about sixty feet above the gutters of the leads.

"3rd. The Hard Hills are older than the drifts in the leads; and it is probable that a great proportion of the drifts in the leads has been derived from the Hard Hills.

"I have not seen the White Hills, Bendigo, since 1853, and I have never examined the hills at Castlemaine to which you refer; but I believe the Hard Hills are of the same age as the Bendigo White Hills, both belonging to the older pliocene gold drifts.

"I am of opinion that none of the gold in the gutters of the leads, having their sources in the Hard Hills, has been derived from quartz reefs."

Mr. Lynch's remarks on the Snake Valley Lead will be useful both to the geologist and the miner:—

"The course of the Snake Valley Main Lead, from its origin in the Hard Hills, is northerly up to the Magnum Bonum claim. It then takes a north-easterly direction by the Carngham United, the Picton, and the Cairngorm, to the eastward of the Green Hill (volcanic); and it is a remarkable fact that this lead, from its source to the Magnum Bonum, has been immensely rich, and that beyond this point it has proved unremunerative. There is no gradual change from richness to barrenness, the Magnum Bonum being, I believe, the richest on the lead; and the Carngham United—the next claim a-head—so poor that successive companies have left it through inability to make it pay. This sudden change is accompanied with a conspicuous alteration in the color, volume, and consistency of the washdirt, and there is a sudden fall of some twenty or thirty feet in the level of the gutter. Up to this point the washdirt is generally compact, and mixed with what the miners term pipeclay; but below it is found a mass of loose sand and water-worn quartz, and reef boulders and *débris*, reminding one of a shingly beach. The washdirt, too, is spread over a very extensive surface, in some places to the width of several hundred feet. Within the Carngham United the Snake Valley

Lead is joined by one tributary lead from the west, and two or more from the east. These channels, I believe, were formed at some period subsequent to the formation of the Snake Valley Lead. The channel from the west comes from the Britannia group of quartz reefs, forming in its passage the Britannia Gully, and the Sir Charles Darling Lead; and those from the east come from the Smythesdale and Black Hill ranges, forming, after their union, the Ballaarat Lead, and intersecting in their courses numerous quartz reefs. One would imagine that the junction of so many leads—one of them very rich up to a point not far from the junction; the others intersecting quartz reefs, and one of them proceeding from the vicinity of remunerative quartz—would make the claim within which the junction is found richer than any other claim in the locality. Yet this is not the case. It can be accounted for, in my opinion, in no other way than that those tributaries (none of which proved to be worth working) have not passed through any of the older rich deposits, such as those of which the Hard Hills are composed. They brought to the Snake Valley Lead no rich drifts; but, on the contrary, helped, by the force of their united currents, to scatter over a wide surface that which was before confined within moderate limits.”*

According to the plans forwarded by Mr. Lynch, it appears that the main Smythesdale Lead has been traced for a distance of nearly fourteen miles, and the Happy Valley Lead for about four miles.

The following facts relative to the operations on the leads are taken from special reports furnished by this gentleman.

The first registered deep lead in this division was Warren's Lead. It was registered in January, 1857. In October of the same year, the Norfolk Lead was discovered, and within a month after the Contest Lead at Brown's, Watson's Lead, and German Lead were opened. All these leads at their sources, and for a considerable distance along their courses, were free from hard-rock, but there were heavy drifts which greatly impeded mining operations. The miners could, in those days, only avail themselves of the whim, and this proved inadequate to meet the difficulties. The areas of claims were very small, and consequently companies were unwilling to incur the expense of procuring steam engines. The result was that, after many unsuccessful attempts to battle with the drifts during a period of twelve months, the leads were abandoned. Things remained in this state until the Government initiated the leasing system, when, encouraged by the large areas obtainable, the leads were again occupied and wrought with marked success. In June, 1858, Mr. Lynch prepared a return of the losses incurred on Warren's, Norfolk, Contest, German, and Watson's Leads, from which it appears that on Warren's Lead alone the temporary abandonment of the claims resulted in a loss of £66,290.

Mr. Lynch states that in his opinion no circumstance proves more forcibly the beneficial effects of the leasing system than the results of the operations on the deep

* This account of the change in the character of the Snake Valley Lead well deserves attentive consideration. It is commonly believed that, at points where old stream beds unite, the washdirt must, of necessity, be rich and plentiful; and it is usual for miners to endeavor to secure claims in places where leads are supposed to form a junction. In the immediate neighborhood of Ballaarat, where nearly all the leads are rich, this is well enough; but, in other places, the miner should be careful to ascertain the character of the tributaries and main leads. A very rich lead may have been rendered worthless by the influx, from a tributary, of great quantities of water charged with non-auriferous sands and gravels, derived from a large drainage area. To find the channel widened, the auriferous gravels and sands dispersed, and the washdirt unremunerative, are phenomena common enough, but not always so well explained as by Mr. Lynch.

leads in his division. When the regulations were first promulgated, the leads were deserted, after having entailed enormous losses on the miners; but as soon as companies were able to get blocks under lease, varying in areas from ten to twenty acres, the auriferous tracts were again taken up. From one block of twenty acres, occupied by the Great Western Company, there were extracted, in less than two years, 16,440 ozs. of gold; and out of a small adjoining block, less than four acres in extent, 2,092 ozs. He estimates that, from the source of the lead to its junction with Brown's Lead, there were obtained at least 65,000 ozs.

The strata on Warren's Lead, near the Great Western claim, are thus described:—

	Feet	in.
Loose gravel below surface soil - - - - -	2	0
Red clay - - - - -	28	0
Honeycomb rock - - - - -	15	0
Solid basalt - - - - -	28	0
Gravels and black sandy clays - - - - -	120	0
Loose drift, with much water overlying the auriferous drift	7	0
Total depth to bed-rock - - - - -	200	0

Towards the source of the lead, where there is no basaltic rock, the layers occur thus:—

	Feet	in.
Red clay - - - - -	20	0
Drift - - - - -	15	0
Stiff black clay - - - - -	12	0
Wet sandy drift, overlying the auriferous drift - - - - -	15	0
Total depth to bed-rock - - - - -	62	0

Still further towards the south the basalt thickens, and below the point where the Main Lead receives tributaries from the east and west (Brown's and Black Hill Leads), the clays and drifts nearly disappear,* and the basalt occupies the space from top to bottom.

A section on Brown's Lead shows the following strata:—

	Feet	in.
Surface soil - - - - -	3	0
Stiff red clay - - - - -	40	0
Sandy drift - - - - -	16	0
Black clay - - - - -	12	0
Depth to bed-rock - - - - -	71	0

Brown's old lead was worked in 1856, and the size of claims for eight men was forty feet square. The claims were not registered, and there is no record of the yields. Where it was shallow it was very rich, but with the increase of depth the yield of gold fell off.

The claims on the Contest Lead were registered, but after a short time they were abandoned. It was not until blocks were taken up under the leasing system

* It is therefore probable that the clays and drifts met with in the northern parts of the lead are younger than the basalt.

that the ground was fairly tried; and some idea may be formed of the character of the lead when it is stated that one block of twenty acres—the Great Britain lease—was sold for £19,000. The Mines Royal claim, at the junction of Brown's and Smythesdale Leads, near the Cemetery, commenced operations on the 25th June, 1860, and ceased to work on the 28th June, 1862. During this period twenty-four men got 3,470 ozs. 6 dwts. 4 grs. Other claims, such as the Smythe and Brown's Junction, and Bute, paid exceedingly well. The Golden Stream has obtained 13,707 ozs.; the Try-again, 21,711 ozs.; and the Grand Trunk, gold to the value of £89,412 11s. 6d. All these claims are still in full work. The Wheal-Kitty commenced to work on the 29th November, 1862, and has got, up to date, 11,064 ozs. 12 dwts. 7 grs., the number of men employed being thirty.

The width of the gutter varies greatly along the course of the lead, in some places being fifty feet and in others 200 feet, and the height of the washdirt is from two to seven feet.

The branch leads from Italian, Monkey, and Derwent Jack's Gullies are similar, as regards the strata, to those described above; and, as far as they have been explored, the average depth is 120 feet.

The Happy Valley Diggings were opened in 1854. The character of the ground, the depth of sinking, and the washdirt, were precisely the same as at Linton's, but the stuff got out was richer. In about eighteen months the shallow diggings were worked out by those who could bring but poor appliances and little skill to the work before them. A fresh rush took place in 1860, and the deep leads were taken up, and new discoveries were made; and the gullies and the sides of the ranges were puddled from top to bottom. In the leads the sinking is nearly altogether through basalt. The principal claims were the North American, British, Waverley, Lucky, Robin Hood, Grand Junction, Volunteers, and Cleft-in-the-Rock. The best claims were the North American, British, and Grand Junction.

The leads are bounded on the one side by the Mount Erip Ranges, and on the other by the Springdallah.

Linton's Diggings were opened in 1854. Nuggety Gully, Candlestick Gully, and Bloomer's Gully, were the most important sites. At first there were no regulations but such as the miners themselves made and adopted, and consequently there is no record of the produce of the mines. The old diggers say that the claims were astonishingly rich, and that the gold was principally nuggety. The depth of sinking varies from ten to thirty feet, and the width of the auriferous drift from ten to fifteen feet, and the height of the washdirt is from six inches to three feet. The gullies are bounded by moderately high ranges.

In 1858 the first registrations were made on the Black Lead. It paid for the labor expended on it, but it was never rich. From its source to its junction with the Standard Lead, the depth varies from 50 to 100 feet; and basalt is not touched until the Edinburgh claim is reached.

The Standard Lead—the best at Linton's—was opened in 1860. The average depth is eighty feet, and there is no basalt until the junction with the Standard Lead is reached. This lead is remarkable for the great depth of black clay met with. In some claims it is twenty feet in thickness, and contains throughout large quantities of leaves and grasses and vegetable substances.*

* The strata at Daylesford, in which similar remains are found, resemble this clay, and indeed differ little more from it than in this, that they are slightly indurated.

Carngham Main Lead rises in the Hard Hills, in the dividing range between Snake Valley and Linton's. Where it is shallow it was exceedingly rich. For some years—from 1855 to 1862—it was the chief resort of shallow sinkers, and even now a good many Chinese miners find a living there, by washing the dirt in horse-puddling machines. At the foot of the range, on the north side, the Snake Valley Lead takes its rise, and falls towards the north. The first large rush to Carngham took place in 1857, but it was chiefly confined to the shallow ground north of the site of the Government reservoir. Subsequently, Preston Hill Deep Lead was opened. It was found to run through Mr. Philip Russell's private property; but the miners, by paying a ground-rent and a percentage on the yield, were allowed to work it. The Crown lands adjacent were occupied in 1858, and from that time to the present mining has never ceased along the valley.

The washdirt in some places is 500 feet wide, and there is no water to obstruct operations. The depth of the sinking is from 80 to 110 feet, and the quality of the washdirt is nearly uniform throughout.

About 50,000 ozs. of gold have been got from this lead already. In the Magnum-Bonum claim—twelve acres in extent—where the sinking is 102 feet, and where there are sixteen men employed, there have been obtained, from the 31st December, 1859, up to the present time, 6,639 ozs. 7 dwts. 17 grs.

Mr. Lynch believes that the lead gets poorer towards the north, where it spreads out to a great width; and he suggests that it will probably be traced into the Preston Lead, north of the town of Carngham, and finally unite with the leads from Haddon, and pass through the deep ground which underlies the basalt near Chepstowe.

Mr. Lynch has given the following information relative to the character of the strata found in the claims on the Preston Hill Lead at Carngham, the yield of gold therefrom, &c.—all the claims being in Mr. Russell's private property:—

Name of Claim.	Description and Depth of Sinking.				Yield of Gold.	
			Feet.	Feet.	ozs.	
WHITE STAR - - -	Recent alluvium - - -	-	12	82	350	
	Volcanic clay and trap boulders -	-	64			
	Quartz drift - - -	-	6			
NORTH UNION - - -	Ditto - - -	-	-	82	4,000	
LONE STAR - - -	- - -	-	12	60	200	
	- - -	-	42			
	- - -	-	6			
RED AND WHITE ROSES -	Ditto - - -	-	-	60	300	
NIL DESPERANDUM -	Alluvium - - -	-	12	125	8,000	
	Volcanic clays - - -	-	15			
	Basalt (blue) - - -	-	90			
	Quartz drift - - -	-	8			
VICTORIA - - -	Ditto - - -	-	-	125	6,000	
CENTRAL - - -	Ditto - - -	-	-	125	400	
ROYAL SAXON - - -	Ditto - - -	-	-	125	4,000	
WELCOME - - -	Alluvium - - -	-	12	108	4,000	
	Clays - - -	-	15			
	Basalt - - -	-	73			
	Quartzose drift - - -	-	8			

STRATA FOUND IN THE CLAIMS ON THE PRESTON HILL LEAD—*continued.*

Name of Claim.	Description and Depth of Sinking.						Yield of Gold.
					Feet.	Feet.	ozs.
NORTHERN LIGHTS	-	-	Ditto	-	-	108	3,000
			Alluvium	-	12	115	3,000
WHITE HILLS	-	-	Volcanic clay, with saponite interspersed	-	20		
			Basalt rock	-	75		
			Quartz drift	-	8	165	1,600
			Alluvium	-	12		
BRITISH	-	-	Clays	-	10		
			Basalt	-	63	80	
			Quartzose drift	-			
PRINCE OF WALES	-	-	Ditto	-	-	93	8,000
UNION JACK	-	-	Ditto	-	-	93	2,000
DEFIANCE	-	-	Ditto	-	-	93	800
THISTLE, No. 1 and 2.	-	-	Ditto	-	-	93	2,000
FLYING BUCK	-	-	-	-	-	60	500
			Recent alluvium	-	12	135	6,250
KANGAROO	-	-	Trap	-	108		
			Quartz drift	-	15		
EMU	-	-	Ditto	-	-	140	5,000
ROSE	-	-	Ditto	-	-	144	5,000
OPOSSUM	-	-	Ditto	-	-	140	2,000
BRITISH STANDARD	-	-	Ditto	-	-	150	4,000

When we consider the immense area of auriferous country lying in the basin south of Lake Burrambeet, and north of the palæozoic range which divides the Haddon leads from those trending southwards, and the vast unexplored tract stretching from Skipton to Wickliffe, connected not unremotely with the former by indications which are sufficient for the geologist, if not for the miner; and when we endeavor to form conclusions respecting the character of these, and the leads which are known to follow the line of the watercourses trending towards Lake Korangamite, we are lost in astonishment at the possibilities of immense wealth in localities yet unopened and unexplored. That they will be opened at no distant date is beyond doubt. An examination of the physical features will assist in the development of them. The inland basins, whether small or large, are guides to exploration, and when well marked are sure guides.

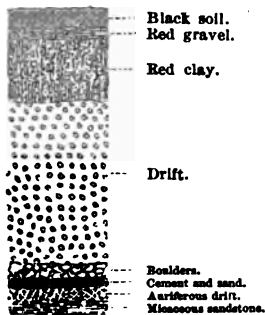
For instance, Lake Korangamite, the physical character of which has been already described, receives numerous streams from the north, and is an inland basin into which several leads must of necessity trend; but whether, where they approach the lake, they are auriferous or composed of the *débris* of auriferous rocks, or shallow, or deep, or wide, or narrow, we know not; and yet a few simple tests would be sufficient to satisfy us on all these points. There is, indeed, but little known as to the character of the rocks which bound the lake. At Bulleen-Merri and Gnotuk, about fifteen miles to the westward, I have found fossils of miocene tertiary age; but whether any similar rock occurs near Korangamite it is at present impossible to say.

According to information furnished to the department, it appears that Lake Korangamite is 346 feet above the level of the sea, Lake Wendouree 1,488'02 feet, Lake Burrambeet 1,286 feet, and Lake Learmonth nearly the same. These are guides to the geologist, and serve to aid his investigations when he seeks to portray on a map the bounding ranges which form the old drainage areas of the period antecedent to the eruptions of basalt and basaltic lavas, which have in some places completely, and in others partially, obliterated them. Having found these, he could trace the leads; and by tracing the leads he would be able to give hints which would set hundreds of willing hands to work, and open out vast tracts of auriferous land. Thus might Science aid Industry, and thus might she secure for herself material support and ungrudged aid.

The quite astonishing reliance which the practical miner places on the feeblest hints given by those who possess scientific knowledge should spur the honest student to unwonted efforts.

The accompanying sections, prepared from drawings made by Mr. Lynch, show the strata as they occur at Darlot's, Lucky-woman's, and Linton.

FIG. 30.

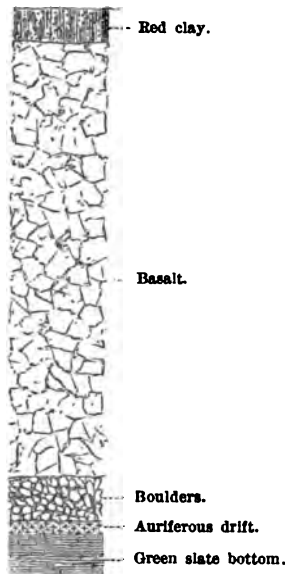


SECTION

At Last Push Company's
Shaft, near Darlot's Sta-
tion, Smythesdale.

FIG. 31.

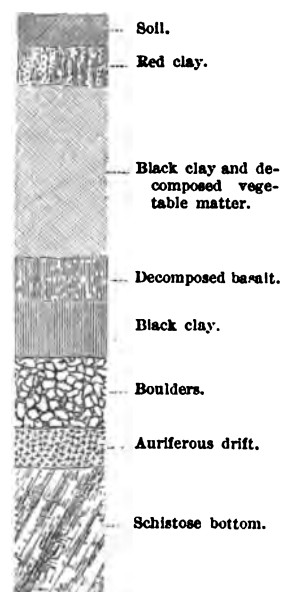
(Scale forty feet to one inch.)



SECTION

Tam O'Shanter Company's Shaft,
Slaughter-house Hill, Lucky-woman's.

FIG. 32.



SECTION

At Lower end of Standard
Lead, Linton's.

About five miles south-east of Mount Buninyong, and overlying the northern edge of the palæozoic rocks, which here as a narrow tract divide the vast extent of basaltic lavas stretching northwards to the River Loddon and southwards to the sea, we find a patch of recent rocks (supposed to be older pliocene) of surpassing interest. They contain deep deposits of lignite. After passing through sixty-two feet of drifts and clays the miners reached a bed of compact lignite more than 100 feet in thickness, and underneath they found a stratum of drift sand overlying the bed-rock. Whether or not gold is to be got at the base of the lower stratum I am unable to say; but gold has been found, and miners have wrought the drifts lying on the margin

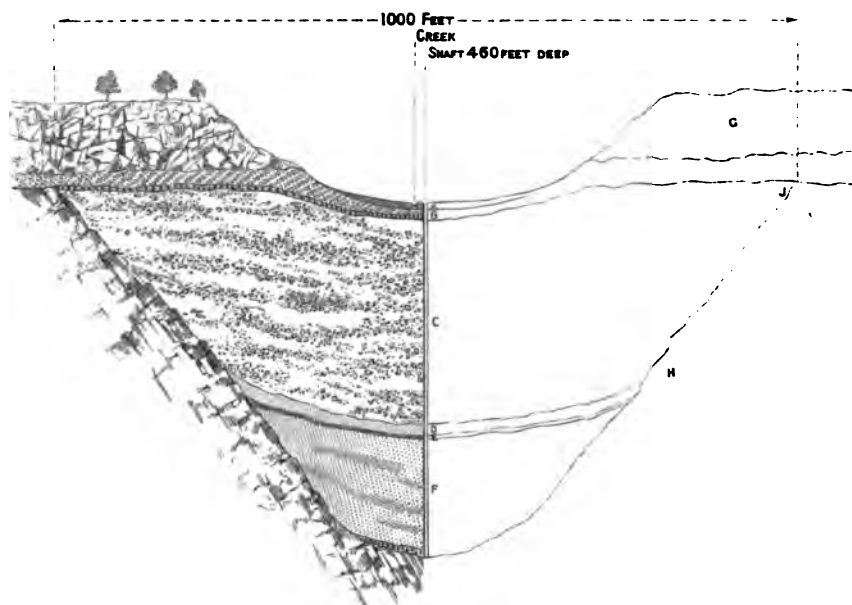
of the basin. In what way this bed of lignite is connected with those deposits found at Sebastopol and on the Whitehorse Lead is at present a matter for conjecture.

Anxious to ascertain to what watershed the lignite lands at Lal-Lal belong (having regard only to the existing surface), information was sought from Mr. Thomas Cowan, the mining surveyor at Ballaarat, and he states that the trend of the surface from the lignite leased-lands is towards the Moorabool, excepting during floods, when some of the water from the swamp within the boundaries of the northern lease is diverted towards a reservoir used for railway purposes; and that the water from the western side of Mount Doran flows under the railway into Williamson's Creek. Though the site of the lignite beds may be said to occupy a small table-land separating the waters of the River Leigh from those of the River Moorabool, it is almost certain that the basin in which the lignite lies belongs either to an ancient tributary of the last-named stream, or to the old bed of the stream itself. If this be the system (and it is almost certain that it is), the lignite deposits will by-and-by be connected geologically with the still more interesting drifts at the Tea-tree Creek.

Respecting these drifts, which are believed to be of miocene age, and not likely to yield gold in quantities sufficient to remunerate the miner, I have been at some pains to get accurate information.

Mr. R. M. Serjeant, the well-known mining engineer, has furnished notes and a section (Fig. 33), which illustrate very completely the mode of occurrence of the strata in this locality. All the ordinary gold workings, as shown in the sketch, are carried on in a recent drift underlying the basalt, and overlying the older strata. The gold in this drift is fine, but generally distributed; and the tunnelling operations for years past have been very profitable.

FIG. 33.



SKETCH SECTION, TEA-TREE CREEK, MOORABOOL.

- | | |
|---|--|
| A Black clay and loam. | E Dark clay with embedded trees and fine gold. |
| B Gravel containing considerable quantities of fine gold. | F Conglomerate drift with layers interspersed with gold. |
| C 320 feet of cement, quartz boulders, &c. | G Basalt. |
| D 9 feet of drift. | H Schist. |
| | J Reef containing coarse heavy gold. |

When the Golden Rivers Company commenced to sink a prospecting shaft designed to penetrate downwards to the bed-rock, many doubts were expressed as to the results; and though the gold obtained has not been sufficient to reward the explorers, the facts they have brought to light are of great value. After passing through a drift containing small well-rounded pieces of quartz and a great quantity of pyrites, the miners struck a seam of black clay enclosing fossil-trees, and a little fine gold; and underneath this a thick stratum of grey sandy clay, with small fragments of fossil wood. On the bed-rock (composed of hard yellow sandstone) the drift yielded gold from every sample taken out. Drives were extended in various directions, and gold was found to be present wherever the sandstone bottom was laid bare; but not in sufficient quantities to pay for working. "The flow of the ancient channel," says Mr. Serjeant, "appears to be north-east; and I have no doubt the drift therein deposited is of miocene age."

It is, perhaps, unnecessary to adduce more evidence; but the questions involved are so important that it is not right to neglect any.

In the report of the mining surveyor for the quarter ending 31st March, 1865, he says: "The Golden Rivers Company, and also the Prince of Wales (now idle) have been occupied for years in sinking to find the bed-rock, in hope of a richer deposit than that which is termed the "false bottom" drift, and they have bottomed at 460 feet from the surface; but not on the lowest portion of their ground, which they are now driving to reach. For a depth of 180 feet there has been little change in the strata, which are wholly conglomerate drift, *with layers more or less interspersed with gold*. What has lately been obtained has induced preparations for passing the material, as brought to the surface, through sluice-boxes."

These facts, as connected with the theory of quartz veins, are highly important. They show, it would appear, very conclusively, that the quartz veins of the pre-miocene era were impregnated with gold, and that all the hypotheses founded on the assumption of a recent cataclysm must be abandoned.

This cannot be too strongly urged if it be true; and unless we are to believe that these drifts are not of miocene age (which is highly improbable, because they have been examined and described by the Government Geologist), it should be accepted as true.*

* Mr. Selwyn, in his *Notes on the Physical Geography, Geology, and Mineralogy of Victoria*, gives the following sections. "The section near the Golden Rivers is:—

1. Upper basalt rock, about 25 to 30 feet.
2. Pliocene gravel, about 50 to 60 feet.
3. Miocene gravel, &c. ('false bottom,' of miners), gravel, sand, clay, and boulders, with fossil leaves and wood, about 400 feet.
4. Silurian slates, &c.

The section on the Moorabool, west of Steiglitz, is:—

1. Upper basalt, 49 feet.
2. Sandy pliocene grit, 10 to 15 feet.
3. Upper coralline limestone (miocene), 13 feet.
4. Older basalt, enclosing bands of hard compact limestone, with fossils.
5. Sandy limestones, with fossils, 30 feet.
6. Rounded quartz pebble drift, and hard siliceous conglomerate rock, with fossil wood, lower part a gravel and boulder drift, 90 feet.
7. Silurian slate and sandstone with quartz veins.

No. 6 of this section represents No. 3 of the Golden Rivers, 3, 4, and 5 being absent in the latter. The thicknesses given are only approximate, and of course vary in different sections."

This very nearly establishes a connection between the beds containing marine fossils, and the drifts in which the gold is found.

That the drifts at this place are not very profitable, because of the difficulties in the way of raising the auriferous earth from great depths, is a consideration relatively of small importance. We may suppose that where fluvial action has been energetic the gold will not, as a rule, be nuggety or coarse and confined to a thin layer, but will be fine and evenly distributed through a great depth of drift horizontally; and yet we are not justified in stating, therefore, that where the miocene drifts are lying in such positions as to be easily explored, and where the auriferous earth can be got out and washed readily and at small cost, the vast areas of this age will not hereafter give profitable employment to many miners.

I have much respect for the honest and earnest convictions of those who have made these questions their study; but I should have erred if I had not stated plainly all the facts I have been able to gather.

Creswick's Creek is a tributary of the Deep Creek which joins the River Loddon, near Eddington. Near the town of Creswick, the abrupt characteristic forms of the palæozoic hills are seen rising above the basalts which nearly wholly surround them; and at various points in the distance appear huge smooth cones, not devoid of a strange beauty, the centres, probably, of once active volcanos.

The gullies in the upper parts of the stream are auriferous, and when followed downwards in the direction of the trend of the creek, they are found to unite, and to form deep leads whose course under the vast sheets of basaltic lava which extend northwards to the River Loddon has not yet been traced.

The basaltic plains extend on the east beyond Mount Bullarook; on the west (north of the Main Spur), nearly to Lexton (measuring in a straight line more than thirty miles); and from the Main Spur northwards to the Loddon, a distance of twenty-nine miles.

This immense area is everywhere surrounded by rich goldfields, and wherever the palæozoic rocks appear above the basaltic lavas, auriferous reefs and gullies and deep leads are found.

The basaltic rocks have not been cut into and denuded, as in the neighbouring districts of Daylesford and Castlemaine. The lava has securely covered and sealed up what we may suppose, without exaggeration, to be as rich a goldfield as any which has yet been discovered. It is almost untouched. The quite insignificant operations at Creswick and Clunes, as far as they have affected the development of the leads, offer no criterion whereby to judge of the drifts which lie concealed beneath the basaltic lavas. Better information is derived from an examination of those places where the palæozoic rocks and overlying drifts appear on the surface. The adjacent workings at Ballarat, Daylesford, Yandoit, Maryborough, Talbot, and Clunes, forming almost a circle around this piece of country, are all very rich; and it seems contrary to reason to assume that the under-surface of the enclosed area will not well reward the labors of the miner.*

It has long been regarded as a probable field for mining enterprise, and there is now some hope of its being opened up.

* There are auriferous leads underlying the basalt in all that tract embracing the sources of the Lal-Lal Creek, and part of the River Moorabool; and in the southern part of the mining district of Ballarat—at Steiglitz—the main *lead*, in the line of Sutherland's Creek, will be opened in course of time. Besides the large areas to which attention has been directed, there are numerous small tracts of an auriferous character; but respecting the nature of the leads in such places it is only possible to speculate.

The deep leads at Creswick are not without interest to the miner.

The Red Streak, one of the richest and the most important among the leads at Creswick, has a gutter which varies in width from 60 to 150 feet, and the overlying basalt is 116 feet in depth.

In the shaft of the Royal Exchange Company, the miners passed through eighty-five feet of basalt, twelve feet of black clay, and nineteen feet of drift.

The Imperial Company, Red Streak, found two runs of auriferous wash towards the south-west of their shaft, the one containing large white boulders, very much water-worn; and the other, gravel of a dark color, mixed with a quantity of decomposed wood. In this run was found a portion of a tree resembling lightwood, about twelve feet in length, and with numerous branches spreading across the drive. The trunk was much decomposed, but the roots were well preserved. This dark run of washdirt, wherever met with in the Imperial Company's claim, has proved highly remunerative.

At the Bald Hill the strata passed through are as follows:—

	Feet	in.
Black loam and clay	6	0
Bluestone (basalt)	22	0
Sandy clay	76	0
Gravel and washdirt	6	0
Total depth	110	0

The gold here is coarse and nuggety.

Mr. H. A. Thompson's notes on the leads of Creswick and Clunes are as follows:—

"At Creswick the old watercourses strike across the present creek in a northerly direction, and several of them (known as the Black Lead, Red Streak, &c.), have been traced for some distance under the trap plains, covering a great portion of the northern flank of the Dividing Range. These leads have, no doubt, formed the head streams of the old valley running to the north, carrying away the water of the district. In endeavouring to trace out the course this main valley has taken, it will be evident that its passage to the west is prevented by the granite ranges of Mount Beckworth, with the schist ranges on its eastern flank, whose tops just show through the trap; while the continuation of the quartz bands of Ballarat and Creswick will probably correspond with the ranges forming the eastern side of the valley, a supposition strengthened by the cropping out of the schist on the course of those veins near Bullarook Creek. * * * * *

"Of the auriferous character of this section of country, the productiveness of the few quartz veins showing above the volcanic rock is a sufficient proof; and there is a fair prospect of the alluvial deposits in the main valley, and in the lateral valleys crossing the quartz veins, being exceedingly rich in gold, as the rapid fall of the country from the Dividing Range would tend to the belief that there had been a more than usual amount of denudation, and consequent increased liberation and deposit of alluvial gold. The rich alluvial lead now being worked at Clunes is probably a western tributary of the main valley. * * * *

"On crossing the Dividing Range at Creswick, we come on the trap plains, extending for many miles to the northward. These are in some places partially wooded, and with a few volcanic cones scattered over the surface, and are intersected by valleys, or rather ravines, having banks so precipitous as often to render the position of the stream imperceptible at a short distance."

Mr. Hoskins, who was engaged in mining operations some years ago, at Creswick, states that the first discovery of gold under basaltic lava was made at this goldfield in October, 1854. The scene of operations was Clark's Hill. The proposal to penetrate the bluestone, in the hope of finding an auriferous wash, was looked upon as a bold, but a useless experiment; and those engaged in it were warned by their friends that their time and labor would be expended fruitlessly. Those enterprising miners persevered, however; and, after sinking through seven feet of hard basalt and other strata, they found washdirt. It was not very rich, and their gains were small; but they developed a new lead, and indicated theretofore unknown sources of wealth. I regret I am not able to give the names of these prospectors.

The deep leads of the Ovens River, and its tributaries, differ from those found in the south-western parts of the colony. Morse's Creek, and the upper tributaries of the river, are hemmed in by steep ranges of palæozoic rocks; and the comparatively narrow flats through which the streams flow do not admit of those great deviations from the course of the existing channel which in other places are so perplexing. But, on the other hand, the immense quantity of water that finds its way into the lower drifts is an obstacle to exploration, which in some places is, at present, practically insurmountable. If a great many claims were taken up in any part of the narrow valley, and if suitable machinery were erected on each for drainage purposes, it would be possible to keep the claims dry, and to get out the washdirt at a reasonable cost; but one machine could not keep a claim of large dimensions in such a state as to admit of its being profitably worked.

Mr. John A. Wallace—the most enterprising miner in the Ovens District—has made many attempts to develop the deep leads in this part of the colony; and, at my request, has furnished for this paper a brief statement of the operations of some of the companies. He says:—"About the middle of the year 1864 the existence of a deep lead, or a 'second bottom,' was accidentally discovered by a party of miners who were searching for a quartz reef on the eastern edge of Morse's Creek. This discovery was made by them while sinking to strike the reef at the place named. This circumstance induced a party of miners to take up ground in the immediate vicinity as a deep lead or wet frontage claim, since known as the Prospecting or Birthday claim, now held by the Birthday Gold Mining Company (Registered). Early in the month of January, 1865, gold in payable quantities was struck at a depth of eighty-five feet from the surface, at which depth the bed-rock was struck, and the depth of the washdirt was about five feet. The ground in which this claim is situated had previously been worked as shallow ground, the 'false bottom,' a sort of cemented gravel, being only about ten feet from the surface.

"The Prospecting or Birthday Claim.—Depth of shaft, eighty-five feet; extent of claim, 800 yards in length; worked 100 yards in length, which yielded 1,783 ozs. 16 dwts. 12 grs. of gold, value, £6,726 12s. 5d. This company have sunk a second or new shaft, 500 feet from the old workings, and are now putting in the main drive there to where they left off. The washdirt met with in this drive yields from an ounce to two ounces of gold to the set of timber five and a-half feet wide, three feet eight inches long, height about five feet,—that is to 100 cubic feet of washdirt. The washdirt is a blue gravel, mixed with quartz. Among the gravel there is a great quantity of boulders of all sizes; which are all blue, smooth, and oval-shaped. The washdirt is open and free for sluicing, and the gold is obtained by sluice washing in boxes. The average width of the lead that is payable is about 100 feet. There are two engines at work on the claim, one of sixteen horse-power for pumping, and one of ten horse-power for winding.

"The Reform Claim.—The adjoining claim to the foregoing is the Reform Company's claim, 600 yards in length. The shaft on this claim was bottomed at about 100 feet. The gutter was not struck in their workings. They drove about 500 feet easterly from the shaft, on the opposite side of which the lead is now supposed to run. This company were obliged to give up the claim, being unable to continue operations for want of funds. It is now held by another party, who intend resuming work thereon in a little time. The engine on this claim is about twenty horse-power, and is used for pumping and winding. The water or suction pipes are nine-inch bore, and are quite sufficient to keep the claim dry. They got some gold in patches on the bed-rock, but not payable. Their shaft is supposed to be about 200 feet from the main lead. Operations on this claim are at present suspended.

"The Garibaldi Claim.—Adjoining the Reform Company's claim is the Garibaldi claim; length, 600 yards. They were obliged to abandon the claim for want of funds. The shaft is down 170 feet, and is supposed to be on the deep ground. It is not bottomed, the engine and pipes being insufficient to keep the water down; the engine is of twelve horse-power, and they have seven-inch pipes.

"Morse's Creek Company's Claim.—This is the adjoining claim to the Garibaldi. Their shaft was bottomed at 180 feet. The extent of the claim in length is 2,000 yards. They have two engines on the claim, one of about twenty-five horse-power for pumping, the other about fourteen horse-power for winding. In this claim about 300 feet of drives have been put in. The lead was not struck in their workings. The wash met with in the drive was a blue gravel. They got some gold in what the miners call 'pot-holes.' Two or three days before they discontinued they struck a yellow wash, mixed with large boulders, the bottom dipping into the hill, or easterly. This wash in the drive went under foot as they left off work; they have done no work in the claim since. The ground worked in the yellow wash was payable. The claim is at present 'suspended' or held in reserve, and exempted from being worked for want of funds.

"The Wallace Extended Company's Leased Ground.—The adjoining claim to the preceding is that of the Wallace Extended Gold Mining Company (Registered). This claim is held on lease; area, about 112 acres; length, about 2,000 yards. They have sunk two shafts, one about 100 feet deep, which they were obliged to abandon. The other shaft is down to a depth of 190 feet; and the supposed depth of the gutter is about 200 feet. There are two sets of twelve-inch pipes in this shaft (that is, two pumps) worked by a water-wheel of thirty-six feet in diameter, and five feet two inches between the segments. The pumps are capable of lifting and discharging about 700 gallons of water per minute. There is also on the claim one engine of fourteen horse-power for winding. The present pumps are insufficient to keep the water under, and operations are in consequence suspended until additional pumping machinery be procured.

"Such is the present condition of mining matters on the Premier Lead, Morse's Creek.

"I omitted to inform you that, in the ground through which the drive in the Birthday claim is now being formed, trees, the remains of the ancient forest, are occasionally met with in a good state of preservation."

Hodgson's Creek, which has its source in the mass of granite lying around Beechworth, and which enters the Ovens about seven miles south-east of Wangaratta, is auriferous in its upper parts, and a deep lead will be found along its course. The El Dorado Lead, lying northwards, which contains oxyd of tin in its bed, as well as

gold, will probably unite with the main channel at some point near Wangaratta, and from Wangaratta the old channel will be traced onwards to the River Murray.

The deep ground quite within the basin of the River Murray is of a different character.

The basin of the Blackdog Creek, which lies to the north-west of Beechworth, measures from Mount Pilot—its south-eastern extremity—to the River Murray about twenty-five miles, and is from five to twelve miles in breadth. It is bounded by well-defined ranges, composed of granites and palæozoic claystones and sandstones.

The beds of the ancient streams are filled with sand, granite drift, and sandy clays; and the streams have shifted so much that the miners find great difficulty in tracing the course of the leads.

The Lancashire Lead, for instance, has its source in granitic and schistose ranges, and in the upper part of it would appear to be an insignificant tributary of the Blackdog Creek; but it has been traced across the existing channel in a line nearly at right angles with it; and at a distance of sixty chains from it is 110 feet in depth. The washdirt contains quantities of oxyd of tin.

The New Hibernia Lead, as far as it has been traced, conforms to the course of the Skeleton Creek.

The New Ballaarat, the Suffolk, and the Sebastopol Leads, have been traced into the Main Chiltern Lead, which is supposed to be the old bed of the Blackdog Creek, and to run rudely parallel to it. The existing channel hugs the range; but the old bed has been traced across the creek, and is expected to run some distance southwards of it.

The Scotchman's Lead, if it be traced onwards, will be found to cross the creek and to form a junction with the main Chiltern Lead.

In this locality the old channels drained areas very different in outline to those belonging to the existing streams.

The following information relative to the Chiltern Leads has been taken from reports furnished by Mr. R. Arrowsmith, mining surveyor:—"The washdirt of the Lancashire Lead is composed chiefly of granite drift with a few fragments of quartz, the most of which is crystallised, and resembles generally that found in the Woolshed and Eldorado Leads. The claim in the deepest part of the lead contains a good deal of tin ore. One washing gave 11 ozs. of gold to 5 cwts. of oxyd of tin. The bed-rock is uneven; there is, properly speaking, no defined lead, the washdirt being scattered over a considerable area.

"The New Hibernia Lead was never accounted remunerative, and was abandoned some three years ago. It was worked for eighteen months altogether.

"The New Ballaarat and Suffolk Leads were dry, and very good returns were obtained from them.

"The Sebastopol Lead has been worked by Chinese miners, and many of them have done well; but the European miners could not make a profit out of the washdirt they got in it.

"The Chiltern Lead is wet, and expensive machinery is required to keep the claims in such a state as to permit of the washdirt being taken out. For a long time it gave profitable employment to a great many miners."

"The deepest shaft yet bottomed on the Chiltern Lead is that belonging to the Extended Sons of Freedom Gold Mining Company (Registered)." It is 235 feet in depth, and the manager, Mr. Nickless, gives the following account of the operations:—"The strata sunk through consist of granitic *detritus*, clay, and drift. The washdirt

varies in thickness from three to four feet, and is very wet. The bed-rock is a white and brownish slate and sandstone; and the width of the lead from reef to reef averages 200 feet. The workings of this company are by far the most extensive in the district. They have two shafts, distant forty feet from each other, one being used for pumping and ventilation, and the other for winding. The size of pump-shaft is six feet by four feet, and it is divided into two compartments, one for the pumps and one for air; and there is a furnace at the bottom. The size of the winding-shaft is six feet by six feet, and has two compartments in which the cages run, which are sufficiently large to contain two trucks on the same level. The apparatus is complete, and works so well that the whole of the timber when put into the trucks can be sent below and conveyed to the face of the drives with as much despatch as a single load of dirt. The average speed of winding is equal to the raising of three trucks per minute.

"Two engines of forty-five horse-power are employed, and the pumps are eleven and a-half inches in diameter. There are three puddling machines, and these are emptied by steam-power, which effects a great saving of labor.

"The number of men employed is 98. The total length of the lead worked is 1,500 feet, and the yield of gold therefrom has been 13,595 ozs. 6 dwts. 7 grs., of the value of £54,062 1s. 6d. The total amount paid in dividends, since blocking out was commenced on December 7th, 1866, is £14,274."

The length of the claim is 9,999 feet, and the Company is now engaged in boring for the lead in the lower or western portion of the claim, where they intend sinking a second shaft as soon as the exact position and depth of the lead are ascertained.* More powerful machinery and a larger number of men will be employed as soon as the lower part of the lead is opened.

* Since this was written the particulars of the strata cut by the bores have been furnished. They are as follows:—

BORE No. 1.	Ft. in.	BORE No. 1—continued.	Ft. in.
Surface soil - - - - -	2 0	Very tough clay - - - - -	4 0
Stiff yellow clay - - - - -	8 0	Red clay, with streaks of white and yellow - - - - -	112 0
Drift (dry) - - - - -	13 0	Conglomerate, false bottom - - - - -	2 6
Stiff yellow clay - - - - -	9 0	Hard cemented granite drift - - - - -	3 0
Fine sand - - - - -	2 0	Coarse gravel - - - - -	3 0
Fine sand (a little darker in color), with a little gravel - - - - -	4 0	Auriferous drift-gravel (coarse) - - - - -	7 0
Fine white sand - - - - -	4 0		
Conglomerate of drift-granite and sand - - - - -	14 0	Total Depth - - - - -	270 6
Arenaceous clay - - - - -	23 0		
Fine yellow clay - - - - -	3 0	Prospect from the bore 27 grains of gold: one piece weighing 19 grains.	
Coarse drift - - - - -	12 0	The bed-rock is composed of soft white slate and pipeclay.	
Fine drift sand, mixed with clay - - - - -	1 0		
White and yellow clay - - - - -	2 0		
Fine drift (no water) - - - - -	4 0		
Very tenacious white pipeclay - - - - -	3 0		
Dark yellow clay, with grit interspersed - - - - -	9 0		
Very fine running drift (much water, commenced the tubbing) - - - - -	15 0		
Stiff blue and red clay - - - - -	2 0		
Light-colored drift - - - - -	1 0		
Stiff blue clay - - - - -	1 0		
Tough black clay, mixed with charcoal - - - - -	5 0		
Blue clay - - - - -	2 0		

BORE No. 2.

Surface soil - - - - -	2 0
Stiff yellow clay - - - - -	18 0
Coarse granite drift, very hard - - - - -	4 0
Stiff yellow clay - - - - -	16 0
Very fine sand - - - - -	4 0
Coarse granite drift, with clay and fine sand - - - - -	14 0
Stiff variegated clay - - - - -	2 0

The strata overlying the leads—composed mostly of sandy clays and rather loose wet drifts—are somewhat difficult to sink through, and the drives require a great deal of timber; and even the utmost care is not sufficient to prevent a serious subsidence where the lead is blocked-out.

The basin of the Blackdog Creek affords room for a great many miners. The area lying to the south has scarcely been touched, and as all the leads must necessarily trend towards the main channel, there is also an extensive tract between the lowest explored point of the Chiltern Lead and the River Murray, within which companies having sufficient capital may fairly expect good returns from well-conducted operations.

The low-level country lying between the range which forms the northern rim of the basin of the Blackdog Creek and the River Murray is everywhere auriferous, and numerous leads have been found in it. As they approach the river they resemble in character the small creeks which in other parts of the colony are seen to trend towards a main stream in places where the drainage areas are limited in extent.

BORE No. 2—continued.	Ft.	In.
Hard red granite drift - - -	4	0
Very stiff variegated clay - - -	3	0
Hard red granite drift - - -	4	0
Red and white clay, very hard - - -	4	0
Stiff yellow clay - - -	9	0
Hard granite, mixed with a little clay -	7	0
Hard red granite drift - - -	1	0
White clay and fine sand - - -	2	0
Fine soft yellow clay - - -	2	0
Granite drift and clay - - -	3	0
Soft white and yellow clay - - -	2	0
Granite drift, with a little water -	9	0
Red and yellow clay - - -	15	0
Red, white, and yellow clay - - -	2	0
Very fine (dry) light-colored clay -	3	0
Fine dark-colored drift, with charcoal -	3	0
White clay, with quartz - - -	3	0
Red clay, with streaks of white and yellow - - -	120	0
Red sand (conglomerate) - - -	0	6
Coarse granite drift, very hard, with very little water - - -	2	6
Auriferous drift (color of gold obtained)	2	0
Total Depth - - -	261	0

The bed-rock is composed of yellow slate-rock.

BORE No. 3.	Ft.	In.
Surface soil - - -	2	0
Sandy clay - - -	18	0
Brown sandy clay - - -	18	0
White sand - - -	2	0
Yellow clay - - -	20	0
White pipeclay - - -	2	0
Red sandy clay - - -	2	0

BORE No. 3—continued.	Ft.	In.
Dark brown sandy clay - - -	14	0
(Water first struck) - - -	2	0
Variegated sandy clay - - -	9	0
Red sandy clay - - -	2	0
Yellow clay - - -	10	0
Yellow sandy clay (more water) - - -	19	0
Red sandy drift - - -	10	0
Yellow clay - - -	10	0
Red clay, with streaks of white and yellow - - -	81	0
Total Depth - - -	221	0

The bed-rock is composed of yellow slate-rock. (No drift, no gravel, and no gold.)

BORE No. 4.	Ft.	In.
Surface soil - - -	2	0
Clay and sand - - -	38	0
Drift - - -	14	0
Clay - - -	27	0
Drift - - -	6	0
Clay - - -	11	0
Clay, sand, and drift - - -	15	0
Clay, mixed with drift - - -	25	0
Black stiff clay - - -	4	0
Yellow and blue clay - - -	18	0
Red clay, with streaks of white and yellow - - -	102	0
Auriferous drift-gravel, mixed with cement (prospect 5 grains of gold) -	4	0
Total Depth - - -	266	0

The bed-rock is composed of soft white slate and pipeclay.

The surface affords few indications whereby one can judge of the trend of the leads, and the underground explorations have not yet been carried far enough to afford data on which correct conclusions can be based.

From the Wahgunyah, Lanarkshire, Robert Burns, and other leads, good results have been got. About 3 ozs. to the load have been washed from dirt about one foot in thickness. The bed-rock in many places is from 90 to 145 feet below the surface, and the sinking generally is dry.

From the Wahgunyah Lead thirty loads gave 64 ozs., twenty-five loads $42\frac{3}{4}$ ozs., and twenty-two loads 36 ozs. 18 dwts.; from the Lanarkshire Lead forty loads gave 70 ozs.; and from the Robert Burns forty-six loads gave 100 ozs.

The washdirt in some places is two and a-half feet in thickness, and has yielded on an average from $\frac{1}{2}$ oz. to 2 ozs. to the cartload.

The Union Lead, at a depth of 192 feet, showed washdirt three feet in thickness, which averaged 15 dwts. to the cartload; and the Glamorganshire, at a depth of 200 feet, showed five feet of auriferous drift, which gave about $\frac{1}{2}$ oz. to the load.

The Homeward Bound was found at a depth of 245 feet, and was very wet. The washdirt, about four feet in thickness, gave $1\frac{1}{2}$ dwt. to five small buckets.

The Mona Lead, with washdirt eighteen inches thick, yielded $13\frac{1}{2}$ ozs. to about nineteen loads.

The leads in this locality, numbering perhaps thirty, are nearly all of the same character. They will be found in every part of the level plain lying between the Indigo Creek and the junction of the Ovens and the Murray.

The *detritus* in the gutters, derived partly from the granite and partly from the schistose areas, is singularly valuable, containing as it does both oxyd of tin and gold; and when capital is introduced, and larger areas of ground brought within the control of companies, the wealth which now lies buried under the sandy plains will be gathered up.

One cause may obstruct operations occasionally. The flood-waters of the Murray will probably reach the lower parts of the leads, and render sinking and the making of drives both costly and dangerous; but in the upper parts of the leads there will never be any other than the ordinary difficulties to be encountered.

Much interest is felt in the development of the leads in this district. They touch, and indeed enter, the vast superficial drifts which fill the valley of the River Murray, and if it be proved that they can be profitably wrought, an immense accession to the auriferous areas will be the result.

Under these drifts we may possibly find other deposits of tin as well as gold; and even if the latter be not very plentiful, and more evenly distributed through the lower beds than is the case in the shallower leads, still the profit derivable from the oxyd of tin will enable the miner to work advantageously.

I have already suggested that the boundaries of the Murray tertiaries, from the north-eastern extremity downwards to the river Glenelg, should be marked out with care and shown on a map, in order that prospecting parties may be in a position to labor successfully. It is commonly supposed that the line is unbroken, and indeed all the published maps represent it as such; but careful investigation will show in all probability that there are many islands of palæozoic and granitic rocks everywhere near the boundary, and also outlying patches of the tertiaries, near which explorations might be made at small cost.

Such a work could be accomplished in a very short time, and would involve but a slight expenditure.

The following table, showing the approximate lengths of the leads in this division, has been compiled from a plan furnished by Mr. R. Arrowsmith :—

APPROXIMATE LENGTHS OF THE LEADS IN THE INDIGO DIVISION OF THE BEECH-WORTH MINING DISTRICT, TAKEN FROM A PLAN FURNISHED BY MR. MINING SURVEYOR ARROWSMITH.

Name of Lead.	Length explored.	Length of probable Course.	Name of Lead.	Length explored.	Length of probable Course.
	Miles. Chains.	Miles. Chains.		Miles. Chains.	Miles. Chains.
Lancashire - - -	1 30	...	Brown Creek - - -	...	8 0
Black Dog - - -	1 8	...	Homeward-bound - -	0 40	2 0
New Hibernia - {	1 60	1 14	Rose and Thistle - -	0 60	3 20
	0 16	1 60	Great Northern - -	0 60	1 60
Kangaroo - - -	0 42	26 0	Union - - -	0 50	1 40
Chiltern - - -	1 12	0 72	Perseverance - - -	1 40	3 0
Sebastopol - - -	1 40	...	Glamorganshire - -	0 70	1 0
Suffolk - - -	1 32	...	Clare - - -	0 40	1 0
Glasgow - - -	0 24	...	Hibernian - - -	2 40	1 10
New Ballarat - -	2 40	...	Clydesdale - - -	0 70	...
Italian - - -	0 36	...	Newcastle - - -	1 0	...
Stockyard - - -	1 20	...	Unnamed - - -	0 50	...
Scotchman's - -	1 0	1 20	Robert Burns - - -	2 0	1 40
Indigo - - -	3 52	8 0	Lanarkshire - - -	1 20	1 60
Old Indigo - - -	3 60	...	Wahgunyah - - -	2 40	1 0
Allandale - - -	0 40	...	Young Wahgunyah - -	0 70	...
Last Chance - -	0 60	...	Rose of Sharon - -	0 60	1 0
Devonshire - - -	1 0	...	Rose of Victoria - -	1 12	0 30
Durham - - -	1 68	0 40	All England - - -	1 30	1 0
Caledonian - - -	2 15	...	Glencoe - - -	0 40	0 40
Kincardineshire -	1 60	...			
White - - -	0 40	...			
Victoria - - -	0 56	0 30			
			Total - - -	52 1	69 56

Mr. Arrowsmith, in reply to a series of questions, has communicated some new facts relating to the goldfields where he acts as mining surveyor; and he has made surveys and taken levels specially for this work, from which the accompanying plan and section* have been prepared.

* The following are Mr. Arrowsmith's notes to the section :—

(a) Red-chocolate colored soil, with a few rounded and sub-angular quartz pebbles. A well has been sunk westward within a few chains of where the section terminates, and at ten or twelve feet a stratum of sandstone, intersected with ferruginous quartz veins, was reached. Water, with a slightly mineral taste, was obtained at a depth of 120 feet.

(b) The surface of this flat consists of a tenacious marly clay (except near the river, where it is of a light sandy description), overlying the ordinary river drifts. It would appear, judging from the position of the rocks at I, and from the fact that the piles at Wahgunyah Bridge penetrate the rock, that there can be no great depth of alluvium.

(c) The banks of the river on which the Wahgunyah bridge abuts present a very remarkable appearance, consisting of a nearly perpendicular rock about fifty feet above the present level of the



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It will be observed that the gutter in the shaft in the New Ballaarat Company, on the Wahgunyah Lead, which is 235 feet in depth—measuring from the surface—is 162 feet below the bed, and 178 feet below the low-water level, of the River Murray.

In the working shaft of the Rutherglen Gold Mining Company, on the Lucknow Lead, the gutter is 176 feet below the bed of the Murray.

In addition to the notes which Mr. Arrowsmith has furnished, explanatory of his plan and section, he has forwarded an interesting collection of minerals and rock specimens, and a piece of fossil wood found in the claim of the Sons of Freedom, at Chiltern, in cement overlying the washdirt, at a depth of 235 feet, which Mr. Tyers, a large shareholder in the company, was good enough to present to the Mining Department.

From Mr. Arrowsmith's letters I extract the following :—"I commenced to prospect at Echo Hill (marked E on plan), and I examined several gravel beds between that point and F (Gooramadda), and from every tin-dishful of gravel I obtained as

water. It consists of brown, white, and red sandstone, and slate-rock. Ferruginous quartz veins are particularly numerous, running in every possible direction, from the perpendicular to the horizontal.

(d) Red soil, overlying clay-slate, and sandstone rock.

(e) Marly clay, much used in brickmaking.

(f) Surface covered with vast quantities of rounded and sub-angular quartz pebbles. Gold has been found in the stone. On the crown of the hill an exceedingly hard dense brown stone is found, while on its northern flank soft slate and sandstone rocks, with quartz veins, are exposed.

(g) A drain in this gully shows a considerable quantity of surface limestone nodules (very small).

(h) Quartz pebbles; brown and red clayey soil.

(i) Total depth of shaft said to be 235 feet. The width of the lead never exceeds forty feet. Where it runs out in a fine drift two feet six inches in thickness, the washdirt is about five feet six inches thick. Bed-rock of the usual schistose formation.

(j) A quartz prospecting shaft has been sunk on this hill, near where the sectional line crosses, which shows three feet of alluvium overlying the sandstone and slate-rock, intersected by several very narrow quartz veins running down quite perpendicularly. It appears to have been sunk several years ago, and no particulars could be obtained.

(k) Quartz pebbles very plentiful on this hill; no exposure of rock.

(l) Shaft about sixty feet deep, and the most southerly on the lead. No section obtainable, but the *débris* round the hole shows the usual schistose rock. This lead has been very poor and unimportant.

(m) The section crosses the extreme end of a small unimportant quartz vein, a continuation of several others which have been worked upon and abandoned. The surface of the hill shows an abundance of quartz pebbles, the alluvium being about three feet thick. On examining the heaps of *débris* round the shafts, a large proportion of soft white sandstone is found, with a little clay-slate. The veins are very small, the largest not being more than four or five inches in thickness. Probably a few tons of good stone may have been obtained. The vein shown on section has been worked to a depth of about sixty feet, where, like many others on these ranges, it has probably run out. The walls are chiefly soft white-looking sandstone, very gritty, intersected with clay veins. The strike of the vein is N. 2° W., with an easterly dip of about 75°. The sandstone dips westerly from 30° to 35°.

(n) This lead is admitted to have been one of the most productive of the Rutherglen leads, the upper portion being thoroughly worked out; but in the lower or northern portion, where it bends to the N.E., water was found in much larger quantities than the machinery in the hands of the miners could possibly contend against; and the ground was consequently abandoned. Prospects were, however, obtained, sufficient to show that it is second to none in the division. It is probable that several feeders may have joined from the numerous quartz veins intersecting the silurian range on the west. The depth of the last shaft sunk was 285 feet, with from two and a-half to five

much sand as could be heaped on a tablespoon, and in almost every dishful I observed gold in extremely fine particles. The total result was about one quart of sand. At Gooramadda I noticed limestone in the clay bank, occurring in a manner which appears to me to be unusual. The pieces are detached from one another, being separated by horizontal partings of clay; they are conical in form, and are perpendicular. Lower down the river there are, I am informed, limekilns where this description of stone is burnt, and the lime is used for building purposes. On examining the river between Carlyle and Wahgunyah I found, at G (Carlyle), a reef of low rocks running about half-way across the river, and rising towards the conical sand hills on which Carlyle is built. The lines of stratification of the rocks are distinct. At H there is a remarkably high rock, partly overhanging the river, and about fifty feet in height. One portion consists of hard dense sandstone, adjoining a slate and sandstone

and a-half feet of washdirt, by a width of lead varying from forty to eighty feet. Where the sectional line crosses, the depth is said to be 160 feet, with a depth of washdirt ranging from two to three feet, by a width of about thirty-five feet. Like the Glencoe, the principal part of the lead is now included in the claim of the Rutherglen Gold Mining Company. A question has often been discussed whether this lead passes through the level ground westward of Brown's Hill, or effects a junction with the other leads to the southward and eastward. The latter appears the most probable, the isolated hill being merely the point of the range.

(o) There is no exposure of rock on the northern flank of this hill crossed by the sectional line, but on its apex, about 130 yards south, several quartz veins have been worked somewhat extensively. The summit of the hill is covered with sub-angular quartz pebbles, and there is a deposit of about two feet of alluvium before the rock is reached. The claims being now abandoned, no details relative to the workings are obtainable.

(p) This lead has evidently originated in the quartz veins intersecting the apex of the low silurian range, dividing it from the All England Lead. It was very profitably worked for several years, until the machinery employed was found insufficient for the deeper ground. An unsuccessful attempt was made to form a company, with capital to procure suitable machinery. Eventually the ground fell into the possession of the Rutherglen Gold Mining Company, in whose claim it is now included. There is no record of the strata sunk through in the shaft shown on the section. The prospecting shaft, a few chains further north, is 130 feet in depth. At the point to which the lead has been traced, the depth of sinking is 260 feet, with sixty feet in width of washdirt, by a depth varying from two to five feet.

(q) On this hill a well has been sunk, about four and a-half chains south from where the sectional line crosses, which shows a thin deposit of alluvium, only a few inches in thickness, covering the schistose rock, which is intersected with quartz veins, differing very slightly in character from the formation found in the shaft of the Rutherglen Gold Mining Company.

(r) The Lucknow Lead is a continuation of the Clydesdale and British Queen Leads, trending northward. The manager of the Rutherglen Gold Mining Company reports having proved a highly payable lead for a distance of 154 feet westward from the shaft, where deeper ground was struck, with very heavy water. This discovery points to the probability of the existence of a parallel lead altogether distinct from the Lucknow Lead, formed by the junction of the Garibaldi, Newcastle, Hibernian, and other feeders from the main ranges to the westward of the Clydesdale. No junction of these leads with the Main Lead has been discovered, and it has long been supposed the Main Trunk Lead would be found to form a junction somewhere near the present workings of the Rutherglen Gold Mining Company. In March, 1867, the Star of Hope Company registered an extended claim on the supposed course of this lead, and they now occupy all the ground to the south of the lease, and westward of the British Queen Lead. The section was furnished by the manager of the Rutherglen Gold Mining Company. The information is from memory only, and therefore not very correct, although perhaps not very far out. The *débris* from the workings of the company's shaft shows a few blocks of rounded sandstone, with large quantities of rounded and sub-angular quartz of which the auriferous drift is chiefly composed. The thirty-three feet of schistose rock sunk through for a pump-well consists of very soft clay-slate and sandstone (with numerous quartz veins), differing only in softness from the schist of the neighboring ranges.

formation, in which there are numerous quartz veins ; and the hill towards the Old Inn is strewn with quartz and sandstone. The rock extends about 100 yards along the bank, but no rock is seen in the water. At I the rocks extend completely across the river, making the navigation difficult and dangerous when the water is low. These rocks are evidently a continuation of the range marked A. The plan and section show very clearly what I conceive to be the ancient course of the river. I am of opinion that the old bed lies between the shaft of the New Ballarat Company and the Wahgunyah Ranges, and that this some day will be found to be the richest lead of gold ever discovered in this district. Anyone who will examine the country as I have done will arrive at the same conclusion. The All England, Clydesdale, Glencoe, and other leads, famed for the gold they have produced, must necessarily pass through this line. Then, again, there are leads from the western side of the ranges. The Wahgunyah Lead has given very large returns, the last shaft at C having paid £6 per man per week on an average, and with insufficient machinery, the company having only a ten-horse portable engine—too small to work a lead increasing in depth, with, of course, an increase in the quantity of water. Besides, the company had paid £500 for the privilege of mining in the paddock for a certain term, and when the term had nearly expired, and it became necessary to make a new agreement, and to provide costly machinery, they abandoned the lead. I have heard some of the shareholders say that the lead would pay £10 per man per week if proper appliances were used in working it. It is to be regretted this company could not persevere. They might eventually have opened up the Murray Lead so often spoken of by miners in this district. As indicating the character of the country adjacent to what I may term the Main Trunk Lead, I beg to refer to the accompanying report, from which it appears that a machine full of dirt taken out of the Rutherglen Gold Mining Company's claim, has yielded 12 ozs. 12 dwts.; nine tons of quartz from a reef have produced 86 ozs. of gold ; and in Jones's Reef it is supposed the quartz will give 20 ozs. per ton. In addition to such feeders, there is a probability, or perhaps more correctly, a possibility of the various leads to the southward following the surface drainage down Brown's Creek, as shown on the plan, still further augmenting the riches of this locality. I am certain it will not be long before some attempt be made to test the question, and, in my opinion, a well-conducted enterprise will be successful. So firm am I in this belief, that it is my intention to map every detail likely to be useful in directing attention to this locality, and I shall do this at my own expense."

The energy, ability, and alacrity displayed by this gentleman in collecting facts likely to be beneficial to the district, cannot be too highly commended, and no one who examines his plan and section can fail to note the care he has bestowed on details too often neglected.

The rich auriferous gullies, trending towards the Bendigo Creek, Sandhurst, unite and form a main lead near the White Hills. This lead has been traced onwards for a length of seven miles ; and, though conforming generally to the course of the creek, is, in some parts, more than half a mile from it. Tracing the line of the deepest ground, from claim to claim, one cannot help thinking that the gutter has not been hit upon in some of them. Below the White Hills the lead receives several tributaries from the westward, but all of them have not been traced into it. The Ironstone Hill Lead, being the outlet for a large area of very rich ground, should have received more attention than it seems to have attracted ; and there is ground near the point where it unites with the Main Lead, and an area west of the junction, which might be

prospected with chances of success. The branches of the tributary leads are in other places rich, and here they would probably well repay the labors of the prospector.

On the east side the lead receives, as far as is known at present, but one tributary, namely, the Forest Lead.

In some respects the Main Lead at Bendigo is of more than common interest. It trends towards, and probably in its northern part overlies, the Murray tertiaries.

It appears—from levels taken by Mr. Hart, from the shafts to the railway bench marks—that the gutter in the bed-rock, in the claims on the lower part of the lead, is only 413 feet above the level of the sea, and not more than ninety-three feet above the level of the River Murray, at Echuca.* The country which it enters, after passing Huntly, is low and level; and, unless it keeps the course of the Bendigo Creek, it will be difficult to follow. It would be interesting to the miner to know the depth of the bed-rock north-west of Runnymede, and at some point below Kamarooka. It would enable him to fix, with some approximation to accuracy, the probable course of the lead, and to form some just conclusions as to the structure of this part of the Murray basin. Until the course of the lead is known it is impossible to say whether the Bendigo Goldfield is an independent drainage area, trending directly to the Murray, or a tributary of the River Loddon, already remarkable for its auriferous streams, or a feeder of the River Campaspe which, though draining auriferous country, is inferior in importance.

Doubts as to the course of the main lead are admissible where the country through which it passes is a wide, open, level sandy tract.

Unless it is fed by the detritus of auriferous reefs, or auriferous deposits, throughout its course, it will not be worth the miner's attention in its lower parts. If it rests on palæozoic rocks, and they resemble those found at Kamarooka, it will be a valuable gutter wherever it is touched; but if it encroaches upon and overlies the fossiliferous tertiaries of the Murray basin, the gold will be too fine, and much too generally distributed through the strata, to be profitably recoverable by any known process.

* The fall from the lead to the River Murray, at Echuca, is 2·074 feet per mile; and the fall of the River Campaspe, from a point forty-four miles above its junction with the Murray, is 3·63 feet per mile. From Albury, which is 490 feet above the level of the sea (low-water mark, Hobson's Bay), to Echuca, the fall is 9 foot per mile.

Unless we are prepared to assume an extraordinary thickness for the alluviums and marine tertiaries of the lower part of the Murray basin, we must conclude that the bed-rock is not at a very considerable depth from the surface at Echuca.

It would be rash to advise any one to sink for gold at this place, but explorations have been made in localities presenting smaller prospects of success.

The facts given here raise questions of interest to the geologist, and suggest changes effected by denudation within (geologically) a recent period, which, I think I am correct in stating, have never before been suspected. By ascertaining the elevation above the sea, of those points where marine tertiaries are found, attempts have been made to define the limits within which the auriferous deep *leads* must be confined; and it has been stated that where the silurian bed-rock is less than 600 or 700 feet above the sea, *leads* will not probably be found. But no allowance seems to have been made for the changes which may have been effected by denudation, since the marine tertiaries appeared above the surface of the sea. It appears to be probable that a vast extent of these rocks has been removed, even within what are now the level tracts of the country. How, otherwise, can we account for the fact that the bed-rock in the *leads*, at Wahgunyah, is little more than 260 feet above the level of the sea? This is a large subject, and I regret I cannot elucidate it here by other facts which might be cited. Important changes have been effected, beyond doubt, in quite recent times; and in no other country has the geologist a better field for the investigation of tertiary deposits than in this part of Australia.

The lowest part explored is called the Telegraph Lead; and if this be the main channel (respecting which there are doubts), it takes a course which leaves room for many tributaries from the adjacent western (underlying palæozoic) ranges.

Where it is called the Huntly Lead it is highly auriferous. At this point it is the outlet for more than thirty square miles of country, every part of which is so rich in gold-bearing reefs that we may not speculate as to the period when they will be exhausted.

If it be fed in a similar way towards the north it will probably be known as the longest lead in the world.

Already, in another part of this paper, information has been given respecting the occurrence of several auriferous strata at Bendigo (and the Main Lead presents more than one), suggesting theories well worthy of attention, but which could not properly be discussed in a paper which is mainly descriptive.

The lead varies in width from 150 to 600 feet, and is overlaid by drifts, which increase in thickness as the lead is followed downwards. Wherever the layers are penetrated it is easy to trace the connection of the strata. No new matter is intercalated, and the miner on finding a layer of sand knows exactly what he shall discover below it, though the thickness of the layer may be uncertain.

From information furnished by Mr. G. W. Hart, now and for many years mining surveyor at Sandhurst, it appears that the strata occur thus:—

	Feet	in.	Feet	in.
Loam and clay - - - - -	2	0	to	4 0
Ferruginous cement - - - - -	2	0	to	4 0
Gravel, sand, and angular fragments of quartz (not waterworn), becoming harder in depth }	20	0	to	30 0
Fine compact gravel - - - - -	-	-		2 0
Cement (sometimes wanting) - - - - -	0	3	to	1 3
Auriferous drift* (first layer) - - - - -	5	0	to	12 0
Very fine compact indurated clay, becoming harder in depth—in some places white and in some places blue }	20	0	to	50 0
Ferruginous cement (auriferous) lying on a clay-slate (true bottom) second layer }	6	0	to	10 0
Maximum depth - - - - -				113 3

The second auriferous layer resembles the first in this, that only the lower part of the stratum is very rich in gold.

When the lead was first prospected the yield was as much as 4 ozs. to the load, and in places (rarely) 12 ozs. to the load. Towards the sides of the gutter—that is to say—near the bounding ranges, it does not appear that the two bottoms are found; but this is by no means made certain.† Invariably the two bottoms are met with wherever a tributary enters the main lead.

* The whole of the washdirt is not usually highly auriferous: generally it is only the lower stratum, about one foot in thickness, which is rich in gold.

† The upper layer lies in a gutter as the lower one does, and necessarily if the lower gutter is wider than the upper, and overlaid by sand and drift, the upper auriferous layer cannot be found on the bounding ranges of the lower gutter. The lines which define their lateral boundaries are

The thickness of the washdirt when the Epsom Lead was first opened was reckoned on an average to be two feet throughout, but only six inches of the auriferous gravel, with the thin layer of cement and about four or five inches of the bed-rock, were taken out. This was done because as a rule the most of the gold was got from the cement and the upper parts of the bed-rock.

Wherever the lead makes a sharp bend, or where a large basin is found, or a *crab-hole*, the washdirt is generally thicker and richer in gold than in other different parts. Near the Pottery Flat this is particularly noticeable. Wherever pockets or holes occur, rich gravel is invariably found in them. As much as 200 ozs. have been taken from one of these pockets.

Mr. Wm. F. Hoskins, one of the officers of the Mining Department, who is well acquainted with the Main Lead at Bendigo, has made some notes respecting the principal features of it, which are worthy of attention. He observes that for a considerable distance downwards the lead is dry. Water, he says, was first found at a depth of 110 feet. Having regard to the position of the lead—the outlet for a large area—and its height above the sea-level, the absence of water is certainly remarkable. The cement or conglomerate is described by him as peculiar in its character. There are two layers, one formed on the top of the washdirt, from one foot to seven feet from the bed-rock, where the gold is of the finest character, so much so as to be called by the miners *point-gold*, yet so thoroughly intermixed with the rock and in such quantities as to yield $1\frac{1}{2}$ ozs. to the ton in some cases, and an average of 5 or 6 dwts. This layer is very hard. Sledge hammers are used to break it down, and blasting powder would be largely employed if it were not for the character of the overlying stratum, which is a loose sand, and, if much shaken, would endanger the workings. The second layer of cement lies on the bed-rock. It is much thinner than the first, and is from one to four inches in thickness. Some of it is brittle and even friable. This layer has been found in places exceedingly rich, and seams of it apparently run into the bed-rock to the depth of eighteen inches. The average yield of this stuff has been about 1 oz. per ton.

Mr. Hoskins gives a section of the strata in one shaft:—

	Feet.			Feet in.	
Sandy loam	-	-	-	1	6
Sandy clay	-	-	-	10	to 12 0
Gravel (like the metal of a road)	-	-	-	30	0
Sand in layers	-	-	-	30	0
Tough clay	-	-	-	4	to 6 0
Fine drift sand	-	-	-	11	6
Gravel and boulders	-	-	-	3	to 9 0
Depth to bed-rock	-	-	-	100	0

He says that, from several of the little pockets and crevices in the bed-rock, he has taken from 2 to 3 ozs. of clean gold.

not co-incident. If the layers be regular the upper auriferous stratum would be found above and at some distance from the outer edges of the lower gutter. Mr. Hart does not say whether the upper gutter follows the same course as the lower one. It probably does not. And if we knew where the deviations occur (if there be deviations), we should learn more relative to the conditions under which this rather complex arrangement of strata was effected.

One of the feeders of the Main Lead—the Ironstone Hill—presents a feature which is somewhat uncommon. The surface of the hill is covered with a very hard ferruginous cement, containing gold, about four feet in thickness, which is very difficult to penetrate; and on the summit the sinking varies from eight to twelve feet; but ten yards away from the summit the bed-rock is found at a depth of fifty feet. In the lower levels the washdirt was very rich. This gives a clue whereby one might arrive at some just estimate of the work which has been done by the main stream in past times. Through long periods it flowed over the tough and hard cement which is now found only on the hill, but afterwards it penetrated this stratum, and cut deeply into the soft claystones, forming a channel at a much lower level, similar in appearance to those which are observed now in places where the grass-covered soil is broken, and the flood waters are making new beds.*

* In new countries there are things to note which never present themselves in older settled lands. Questions of great moment of every kind are at once broader and simpler than in ancient states which are thickly peopled. What is known of the ancient forests, the original watercourses, and the native grass-clad surface of England? But little that can be relied on. Before tamed cattle trod on the grass, before men delved the ground, and before roads were made and channels constructed, things were very different from what they are now. Here, in Australia, we may observe the surface as Nature has formed it. The Aborigines have not spoiled it, nor improved it, nor scarcely at all altered it; but where the cattle of the settler cross a well-grassed slope in any part which is naturally moist immediate changes are effected. The surface waters begin their work at some small hole made by the hoof of an ox, and gradually enlarge it and deepen it (always working backwards towards the hill) until a long channel several feet in depth is excavated. In this way, thousands of cubic feet of soil are carried into the low lying valleys by streams in places where for ages there has been no current, and no denudation.

Large swamps, which in the memory of settlers have been dry lands for several years in succession, have by tillage and drainage of the adjacent slopes been converted into lakes which have in a brief period increased in depth and area, and inundated large tracts of fertile land. Lake Learmonth, Lake Burrambeet, and notably Lake Modewarre, are instances of this kind of action.

From records made by the Land Surveyors it appears that in 1841 the bed of Lake Burrambeet was quite dry and overgrown with fine silky grass, and mussel shells were abundant on the surface. When the lake was full the water was said to be salt. In 1849 there was fresh water to the depth of four and six feet. At the present time there is a great depth of water, and the lake is a conspicuous feature in the landscape; and, when I visited it in October, 1868, there were boats on it, and the proprietor of them told me that he was about to purchase a small steam vessel to ply between the northern and southern shores.

Mr. John Steavenson, the Assistant Commissioner of Roads and Bridges, informs me that, twelve years ago, he was well acquainted with the features of Lake Modewarre. Then the waters were salt—quite unfit for domestic purposes, or even for cattle, and characterized by that peculiar, almost fetid, odour and taste which belong to the waters of many of the salt lakes. Of late years, since the adjoining lands have been cultivated, roads and drains made, and the natural surface of the drainage area in many parts denuded of timber and grass, he has tasted the water and found it quite sweet and wholesome. The lake is now from ten to twelve feet above its original level; and many farms have been submerged.

Important changes of a similar kind have occurred at Lake George, on the western slopes of the Cordillera, in New South Wales, and in the neighboring lakes lying on or near the Cordillera in lat. 35°.

The increase in the quantity of water in our lakes is likely to be in every way beneficial; but the operations of Nature, if allowed to continue unchecked, result otherwise than we could desire when we consult only our profit and convenience. The increase of the waters in Lake Burrambeet, the Mount Napier Swamp, and in other natural basins, gives increased power to the overflow; and the cutting-back power will in time reach the basins and drain them completely. A small expenditure of time and money would effectually check the erosion now going on at the outlets; and it ought to be attended to at once.

Mr. J. T. Richards, Mr. J. R. Hoskins, and other practical miners who have worked on this lead, have freely communicated facts which have come under their observation.

They may be thus summarized:—

The washdirt, which contained the greatest quantity of gold, was found invariably not in the middle of the gutter, but on the bounding slopes. Fossil wood or leaves, or other organic remains, have not been found in any part of it.

No auriferous quartz reef has been found in the vicinity of the lead north of the White Hills.

The Forest Lead differs from the Main Lead. The washdirt in the former consists of fine white gravel without cement; and the gold is spongy and not much water-worn. There is a quartz reef in the upper part of the lead, but no gold has been found in it.

Samples of gold taken from the main lead have been generally good; the very minute particles always being the best, assaying about $23\frac{1}{2}$ carats.

When the lead was first opened the miners washed the auriferous stuff in the long-tom, and of course failed to get much gold from it. Some of it being in fine films in the interstices of the cement, and some thoroughly mixed with the rock, it was impossible to get more than a small proportion of it by washing; and not until they sent the stuff to the mills to be crushed, did they ascertain the value of the washdirt and cement in the lead. When they came to know what these contained, thousands of tons of abandoned tailings were collected and crushed, and fresh efforts were made to develop the resources of this part of the Sandhurst Goldfield. These efforts have proved highly successful.

According to a report published in the *Bendigo Advertiser*, on the 17th June, 1868, there is every probability that the Main Lead will prove not only profitable to the miner, but will present features of great interest to the geologist. In one part the miners have traced the washdirt up to a steep bounding wall (formed of palæozoic rock), about six feet in height, near which the gold in the drift is coarse; and they have found crab-holes filled with large boulders. The stuff got out of the claims yields as much as 8 dwts. and 10 dwts. of gold per load.

Mr. Pike, the manager of the Huntly Deep Lead Company, says that the lead in its lower part, up to the point where it is very wet, has not much altered as regards its character. It is still a wide run of deep ground with a heavy wash, the whole of the lower stratum being intermixed with cement; and where the miners find a cake of cement about half-an-inch in thickness, the wash is invariably rich. In some places a layer of cement from one to six inches in thickness, which runs into the washdirt, as well as one foot of the reef, is taken out and put through the mill.

The gold, as a rule, appears to follow the eastern side of the wide gutter, and that side carries also the most of the quartz-wash. On the western side angular fragments of sandstone are found.

In the centre of the lead where the deep crab-holes are met with there is little gold, and it is very fine, and got mostly out of the gravel at some height above the bottom. The best washdirt is found along the sideling; not in the deepest ground nor on the marge of the gutter.

The water in the lead on the Bendigo Flat is but slightly brackish, and the inhabitants use it readily for domestic purposes; but where the lead leaves the flat

and extends towards the east it becomes quite salt.* The water, although met with in large quantities, appears to be dead-water, and as soon as a claim is once drained it does not make again unless by rain or floods.

The width of the paying ground in the main lead varies, Mr. Pike says, from 100 to 400 feet.

The auriferous gullies in the western part of the Bendigo Goldfield trend towards Myer's Creek. These gullies are fed by numerous rich quartz reefs, which extend far northwards; and wherever they have been opened the miners have met with success.

Though it was well known that Pegleg Gully, Sailor's Gully, Napoleon Gully, Wellington Gully and others must necessarily fall into the old stream-bed lying beneath the strata over which Myer's Creek now runs, no attempts were made for a long time to open up the lead. A patch of alluvium was wrought some years ago, up to the boundary of the private property at Widdekar, but it was soon abandoned; and, even after the true lead was touched at Sebastian—about six miles to the north—but little attention was given to the intervening tract of auriferous land. In any other country this neglect of obvious resources could scarcely occur; but in Victoria the miners have ample room, and so many well-known reefs and leads and shallow alluviums to resort to, that, unless there are brilliant prospects before them, they are slow to spend their time in prospecting.

Some of the miners, however, impressed with the belief that gold could be got in the old stream-bed at Myer's Creek, commenced to sink north of Widdekar, and they very soon found a lead. I had an opportunity of inspecting it shortly after it was opened, and the following facts connected with it are taken from the report which I made to the Honorable the Minister of Mines:—

The new goldfield will probably be found to be an extension of the old workings, which were discovered some time since at a point south of the 240 acre block on Myer's Creek, known as Campbell's paddock. The new workings commence on the western boundary of this paddock, about twenty chains from the north-western angle, and they have been traced north-westwards for about three miles. In my opinion, there is a true lead or old channel running on the west side of, and nearly parallel to Myer's Creek. It is the old watercourse which in times past received the drainage of Sailor's, Pegleg, and other gullies; and it will undoubtedly be traced onwards to Sebastian, and beyond it. It is the opinion of many of the miners that it is not a lead; but, after carefully examining the strata, I am convinced that it is as much a lead as any existing in this part of the country. It differs from those of

* Mr. Geo. Avery Fletcher, the engineer of the Sandhurst Borough Council, has lately directed my attention to the qualities of the water used at Sandhurst for washing stuff containing gold in very minute quantities. It appears that the brackish or salt water pumped out of the mines is useless for washing purposes, where the gold to be recovered is very fine. The Chinamen have discovered and made known this peculiarity of the brackish water. In ordinary cases the waters of the creek enable them to pursue their labors profitably, but where the clear water pumped out of the mines is diverted into the creek they are obliged to seek for supplies elsewhere. With rain water they can recover very fine gold, but with brackish water they get from a fourth to a third less.

I cannot state exactly the specific gravity of the water got out of the claims at Sandhurst, but it is certainly not much below that of sea-water. Sea-water contains salt in the proportion of about 1 lb. of salt to 33 lbs. of water; and Dr. Schweitzer's examinations of the water of the British Channel, show that the specific gravity is 1.0274 at 60°. With water of a high specific gravity, it is plain that successful washing must be impossible where the gold is very fine. Surely this matter deserves investigation.

Ballaarat, Daylesford, and the Ovens, where the lithological character of the underlying rocks is different. It has not those clear, sharp boundaries which are found in places where the underlying rock is hard and tough. It is not a deep, well-defined channel, and it bears the same relation to the modern watercourse as the old leads at the places I have named bear to the modern channels which have replaced them. On the western boundary of the paddock, which the lead intersects, the miners have sunk several shafts to the bed-rock, which here, and as far as I could ascertain throughout, is composed of an exceedingly soft yellowish or white sandstone, in very thin leaf-like layers, with here and there very narrow veins of peroxide of iron with gold, intersecting it. A section across the lead at this point shows the following strata:—Rounded and angular quartz gravel in ferruginous earth, eight feet to ten feet; very fine soft yellow shale, evidently derived from the breaking-up and re-deposition of the bed-rock, four feet to five feet; hard gravel, with an argillaceous and ferruginous cement, eighteen feet to twenty feet. On the bottom are found rounded, and in some places but slightly worn angular masses of quartz, ranging in size from an inch to a foot in diameter. Further northwards commences a stratum of very ferruginous clay and quartz gravel, which seems to thicken in the direction of the lead, and to lie mostly on the west side of it. The washdirt taken off the bottom is a dry yellowish clay, enclosing many pebbles and angular pieces of quartz. It is not easy, but it is not impossible, to mark the general course of the lead from the indications observable on the surface. Though the country appears at first sight to be level and even, it is not so. Heavy rain fell during the time I was there, and I could, therefore, easily note the trend of the land. The almost flat valley is bounded by low ridges on each side, rising scarcely more than fifteen feet above the general level, and these ridges are about sixty chains apart. The course of the lead at a little distance from the paddock fence seems to incline towards the western ridge, but it winds no doubt, and may, further on, approach or cross the creek. About two miles from the fence the shafts are deeper, and opposite Bolger's paddock, where the land is cultivated, the bed-rock is found about seventy feet from the surface. * * * * * The ground, as I have already stated, has been taken up for a distance of about three miles, and the breadth occupied by the claims is about five chains, but at one point the claims have been worked out in the supposed course of the lead, or a tributary, for a considerable distance to the westward. It is not possible to give an accurate account of the yield of gold from the washdirt. A great many shafts have been sunk to the bed-rock, but in no case has any great quantity of washdirt been put through the tom. I was informed that some claims had yielded as much as 2, 3, 4, and 5 ozs. to the load, and others the same number of pennyweights. One miner told me that he had washed eleven loads, and had got only $3\frac{1}{8}$ dwts. to the load. In other places they showed me gold in which pieces of 1, 2, and 3 dwts. were mixed with grains and thin flakes. One piece, weighing 12 dwts. 14 grs. had been found. The gold is of good quality and is generally heavy, and it is not all very much water-worn. Several of the miners who were washing at the creek panned off, and showed me good samples. From all I saw, and from what I could learn, I believe that if water be supplied, a great many miners will find profitable employment at this place for many months; but it is not probable that any very rich ground will be discovered. I was anxious to ascertain what quantity of gold had been got at the rush, but I was not successful in procuring accurate information. The manager of a bank to which it is said most of the gold had been sent, informed me that he had purchased 100 ozs.; but, as this quantity he knew represented the prospects from sixty or seventy claims, he concluded that in a

very short time a considerable amount would be raised. I concur in this opinion. Very few of the miners have driven far, and nearly all those who have put in drives have got gold. The hard conglomerate called cement contains much gold, and as soon as crushing machines are placed on this field, the yield will be largely increased. The miners are now throwing the cement aside, as they have no means of getting the gold out of it. They are obliged to use blasting-powder when working in the cement.*

The results of the operations of the miners at this place have been such as to confirm the statements in the above report. No very rich ground has been discovered; but the washdirt everywhere along the course of the lead has given fair returns, and the miners have found profitable employment wherever skill and energy have been used.

The Sebastian Goldfield lying, as already stated, about six miles north of Myers-town, is thus described by Mr. Wm. F. Hoskins:—"The discovery was made by Sebastian Schmidt and Company, in May, 1863, in the ground known as Donald Campbell's Pre-emptive Section. The diggings are situate in a shallow gully between two small ranges. Gold was first got at a depth of twelve feet, and the drift was traced along the small gully, and was found to be about 200 feet in width. The yields from several claims measuring forty feet by forty feet were very good, in some instances being as high as 300 ozs. and 400 ozs., and in others, not on the run of gold, of course, much smaller. The gold was heavy, angular, and seemed to have been carried but a short distance; and was below the value of ordinary alluvial gold. The sinking was exceedingly hard. In some places only a few feet below the surface, and in others at a depth of fifteen feet, where the ground dipped rapidly, a very hard stratum of sandstone was passed through, and underneath this the layers were difficult to penetrate. Many of the miners believed they had reached the bottom when they touched hard ground at a depth of thirty feet; but underneath this, the washdirt, resting on a soft decomposed claystone, was finally reached."

This lead or patch was traced for a distance of 1,500 feet, and the width of the washdirt was found to be about 600 feet, having a depth varying from six inches to three feet. Where it formed a junction with the line of the old bed of Myer's Creek, the sinking increased in depth, and the character of the strata changed, and water in considerable quantities was met with.

Mr. Hart, the mining surveyor, at my request, obtained a section of the strata sunk through in the deeper alluvial mines at St. Sebastian. They are thus described:—

	Feet	in.
Surface soil - - - - -	1	0
Red sandy gravel mixed with fine quartz, loose at the top, but rather more compact in depth - - - - -	40	0
Fine quartz gravel, not waterworn - - - - -	10	0
Very fine white indurated clay, with a slight appearance of stratification, and verging towards cement at the base	43	0
Compact sand - - - - -	3	0
Quartzose gravel, from 3 to - - - - -	5	0
Auriferous drift, resting on silurian bed-rock, thickening towards the east, and running out near the creek - - - - -	5	0
Total depth - - - - -	107	0

* Dated 10th August, 1867.

In the western bank a shaft was lately sunk to the depth of 160 feet; but the water came in in such quantities that the miners were compelled to abandon it.

This lead is fed by an exceedingly rich quartz reef, a description of which is given in another place.

Still further to the westward the miners have lately discovered moderately rich washdirt on the Bullock Creek; and here, as at Myer's Creek and Bendigo Creek, a main lead will ultimately be opened up.*

Where the miners have penetrated the alluvium, the bed-rock is found at a depth of thirty feet. The thickness of the washdirt is about twelve inches; and the yields vary much, but average from 6 dwts. to 1 oz. per load. Tributaries trending westwards towards Bullock Creek, and eastwards towards Myer's Creek, have already been opened with good results. According to the reports published in the *Bendigo Advertiser*, it would appear that a large field is likely to be found between Myer's Creek and the River Loddon. The area is extensive; the rocks are of precisely the same character as those found in the Bendigo Valley; and that rich alluviums have not been discovered in this area as in the other is probably due to the fact that the auriferous strata are in most places covered with thin drifts, and that the country is level. If it had been broken into hills and valleys by numerous watercourses, it would have been as well known as Bendigo.

It is not possible to give much information relative to the deep leads in the Maryborough District, because but little has been done to develop them. The areas where they are known to occur are large; the drifts, as compared with some others, are rich, and the difficulties connected with the exploration of the gutters are not numerous nor great; but the local bye-laws, operating prejudicially for a long period, have fairly deadened enterprise, and, though the restrictions placed on capital are not now so severe as they were formerly, persons are slow to invest money in the valuable mines of this district. Its character, in fact, stands in the way of its advancement.

The auriferous tributaries of the Timor Creek unite and form a lead which joins the Bet-Bet Creek, near the village of Timor. The tributaries of the Four-mile Creek run into the Bet-Bet, near the point where this stream is joined by the Burnt Creek, whereon are situate the rich goldfields of Dunolly, extending south-easterly from Mount Moliagul for a distance of more than fifteen miles. It is probable that a lead, corresponding with the course of the Four-mile Creek and the Bet-Bet Creek, will be traced onwards to the Loddon.

There are deep leads near Mount Greenock which are exceedingly interesting, occurring as they do in the neighborhood of what many persons believe are extinct craters; and eastward of the Mount Greenock and Deep Creeks, under the basaltic lavas stretching from thence to the River Loddon, there must be an under-surface of rich drifts.

Further north, on both sides of the River Loddon (that towards the east being in the Sandhurst District), rich leads, trending from the ranges on which the quartz veins out-crop will, in due time, be opened by the miner; while towards the west, on the sources of the River Avoca, and other streams, large areas of deep ground may be looked for.

* In the country lying between the Bendigo Creek and the River Loddon we shall probably find systems of *leads* presenting the same herring-bone structure as at Ballarat. Each main *lead* with the smaller *leads* trending towards it from the bounding ranges on the east and west, when mapped out, will present the characteristic form described by the word which I have here applied to it.

When we examine the country, throughout which so many rich patches of alluviums and good thick solid reefs have been opened, and consider the extraordinary yields which have been obtained from them, it occasions surprise to observe that nothing has yet been done towards the exploration of the deeper drifts trending towards the Loddon, the Avoca, the Avon, the Richardson, and the Wimmera.

What has been done at Mount Greenock, towards the Bet-Bet, at Lamplough, and at Avoca, is a mere scratching of the surface, when we contrast it with the work effected at Ballarat.

In one of the claims north-west of Maryborough, where the gutter is about 160 feet below the surface, the washdirt yields about 1 oz. per load.

In the Mount Greenock Lead twenty loads of washdirt, taken from a stratum eighteen inches in thickness, gave 32 ozs. of gold; and, in some places, rich patches have been met with, giving 1 oz. to the tub.*

But a better idea may be conveyed of the character of the leads at Mount Greenock by a description of one well-managed mine, than by general statements.

Mr. Joseph Smith, mining surveyor, has, in answer to questions, supplied the following information relative to the Sadowa Company's mine, at Rocky Flat, Talbot; and furnished, also, plans and sections from which the accompanying figure has been drawn.

The works were commenced in August, 1862. The first company sank No. 1 shaft, which was found to be too shallow, but they, nevertheless, placed a small steam-engine on the ground, and drove eastwards (the drive dipping) for 112 feet, but did not find gold. A drive was then put away southerly, which came upon deep ground, but the shaft was abandoned and the company broken up.

The second company was formed in June, 1863, and they sank No. 2 shaft and procured a steam-engine of ten horse-power. Washdirt was found at a depth of 113 feet; but they opened out to the north at a depth of 124 feet, and found they were not deep enough when they came to meet the other drive. They then opened out N. 77° E. towards the part which is shown on the plan as blocked-out, which gave 1,800 ozs. of gold, but the drives were too high to enable them to get at the gutter. A quartz reef about thirty feet in thickness was intersected in this part of the workings, but no gold was found in it. The quartz was white, and where opened was mixed with pipe-clay.

This company ultimately ceased to work, and the claim was abandoned.

A third company was then formed, and No. 3 shaft was sunk to a depth of 160 feet (*see section*). The ground was opened out at 146 feet below the surface, and two main drives put in; and gold was found, but not in quantities sufficient to satisfy the shareholders, which caused the company to despair, and the fine plant was sold for £1,000 to the present, or fourth company. After a further expenditure of £500 the works did not answer expectations, and it was feared that the claim would again be abandoned. But better counsels prevailed. The mine was let to tributers in May, 1867, who energetically combated the water. They raised nearly half a million of gallons per diem, and ultimately got down to the washdirt, and were soon able to raise from 17½ ozs. to 40 ozs. 12 dwts. of gold per diem.

The thickness of the washdirt is from two to six feet, and the breadth of it is not known. The average yield is about 14 grs. of gold per truck, but some parts of the mine are much richer than others.

* *Mining Surveyors' Reports*, p. 390, vol. III.

The drives are from five feet by three and a half feet to six feet by four and a half feet, and the length of drives opened from the commencement is 38.92 chains, of which 21.30 chains are now open.

The area occupied is 142 acres. About 1a. 3r. 6p. have been opened up, and 1r. 6p. quite wrought out from No. 3 shaft.

The gold is got by puddling and sluicing, and no mercury is used in extracting it. There are two puddling machines, each about sixteen feet in diameter; and the sluice-box is sixty feet in length and ten and a half inches in width. The average quantity of washdirt put through each machine, per diem of twenty-four hours, is 300 trucks or sixty tons, and the average yield of gold is 2 dwts. 22 grs. per ton.

The pumping engine is of twenty-five horse-power; the cylinder is sixteen inches, with a three feet stroke; the fly wheel is fourteen feet in diameter; and the pump is ten inches in diameter. The winding engine is of ten horse-power; the cylinder is ten inches in diameter, with eighteen inches stroke; and the fly wheel is eight feet in diameter.

The quantity of water now raised per diem is about 200,000 gallons. It is slightly brackish.

There are sixty men employed on the works.

An account of the proceedings of the Avoca Deep Lead Association, of the numerous attempts to prospect the country near Carisbrook, and of the results of operations on the leads trending towards the Bet-Bet, would properly find a place here, but there is, indeed, little information available.

Throughout the country, north and east of Inglewood, and westwards towards the Avoca, we may expect to hear of the discovery of numerous leads, having very much the character of those found at Wahgunyah, of which a lengthened description is given in another place.

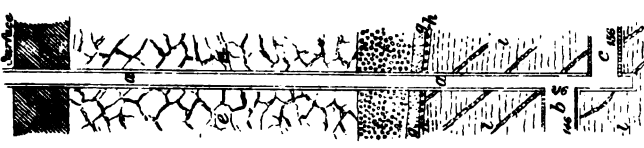
The more important leads in the Mining District of Castlemaine are found in the Daylesford and Fryer's Creek Divisions, at Taradale, Malmsbury, and Blue Mountain. In most places they differ from those of the South-Western Goldfields in this, that whereas the gutters of the latter are invariably at a considerable depth beneath the natural surface of the modern streams, those of the former are a considerable height above them, and are wrought generally by tunnels driven from the sides of the valleys into the hills.

It is not possible to delineate accurately on a map the areas once covered by basalt. Far removed from the volcanic vents from which in past times vast quantities of lava were erupted, we find small patches of this rock lying on the edges of the modern streams, and by connecting these by hypothetical lines with the larger masses lying to the south, we may gain some hints as to the former condition of the country, and form a rough estimate of the amount of recent denudation, but we can do no more.

Under the patch of basalt lying north of Wuid-kruirk (Blue Mountain), there are deep leads; but the course of them has not yet been ascertained with such accuracy as to enable any one to show in what manner they are connected with the modern streams. They are wet and somewhat difficult to work, and it would be premature to give any opinion as to the value of them.

In the Daylesford division, where there are rich shallow workings, the leads, as might be expected, have been well explored. Situate in the neighborhood of once active volcanoes which have poured out lava in great quantities, we can easily trace the lines of the streams of molten matter, notwithstanding the changes effected by denudation. Standing on any one of the centres of volcanic action the eye follows

Fig.
SECTION OF S. SHAFT

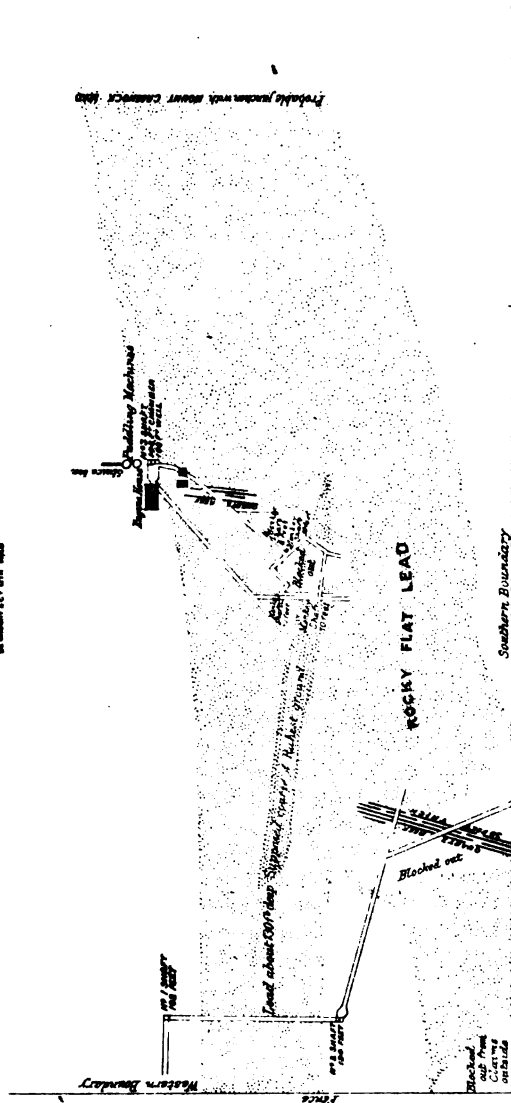


Scale, 50 feet to One Inch

a. Shaft 60 feet deep	f f 14 feet Sandy Drift
b Working Chamber 46 feet down	g g 3 Fine gravelly drift
c Water Chamber 556 feet down	h h 9 inches of Wash Dirt
d d 13 feet of stiff clay	i i i Soft, pyroclastic, soft sandstone, and quartz vein
e e 78 feet of Basalt	

Fig.
SADONIA COMPANY'S WORKINGS, ROCKY FLAT.

PLAN
TEMPERATURE 1907

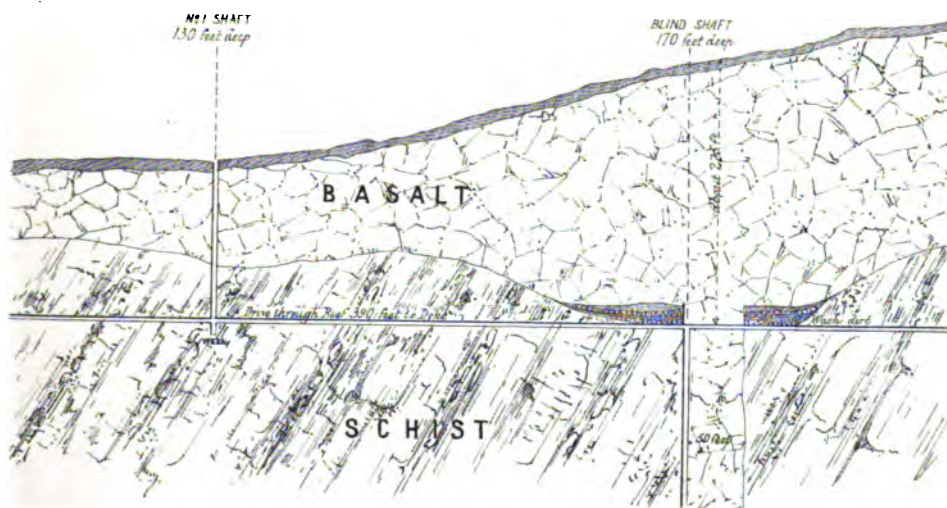
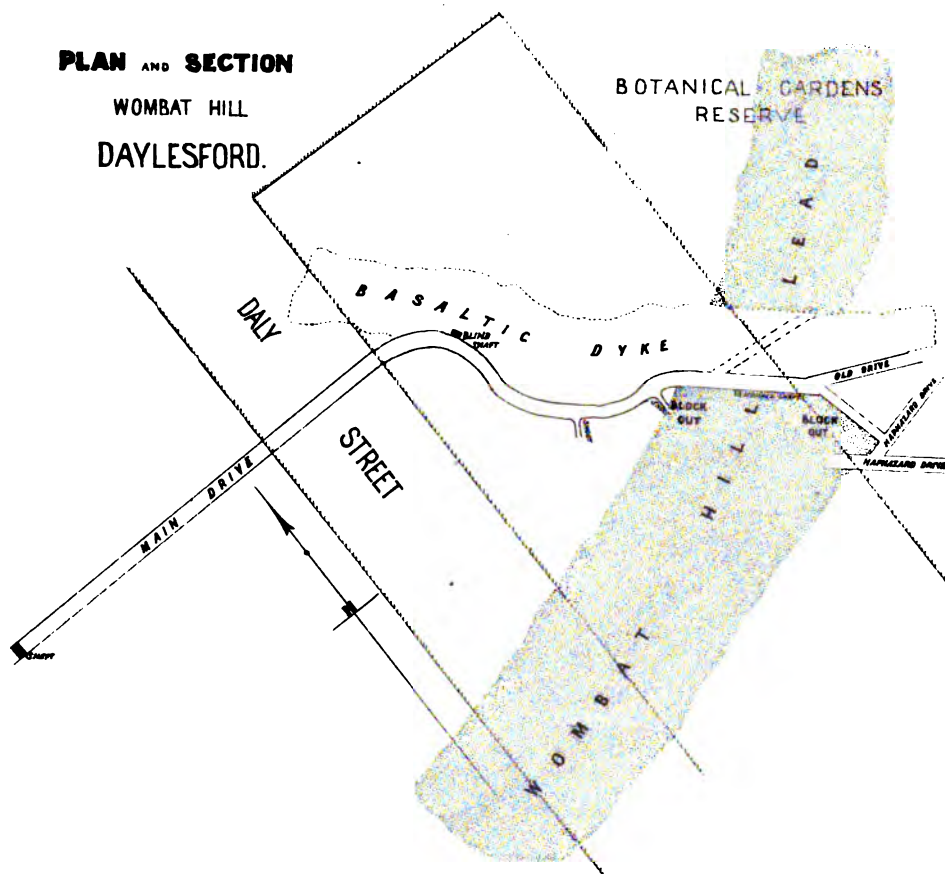


Scale, 60 feet to One Inch

M. Joseph Smith, Mining Surveyor
9th May 1907

PLAN AND SECTION

WOMBAT HILL
DAYLESFORD.



Scale 180 feet to One inch

Drawn by Arthur Everett Mining Surveyor
Melbourne Dec. 16th 1880.

the course of the several streams, and, without exciting the imagination, the mind pictures to itself a former state of the surface, when, in the midst of huge columns of smoke and clouds of ashes, the country, richly clothed with vegetation, was made desolate. The quiet stream pursuing its course through masses of vegetation, was stopped by a red and tumbling current of slow moving lava, and the scene bright with foliage was rapidly turned into a seething lake where the waters vainly combated with an enemy which could not be vanquished.

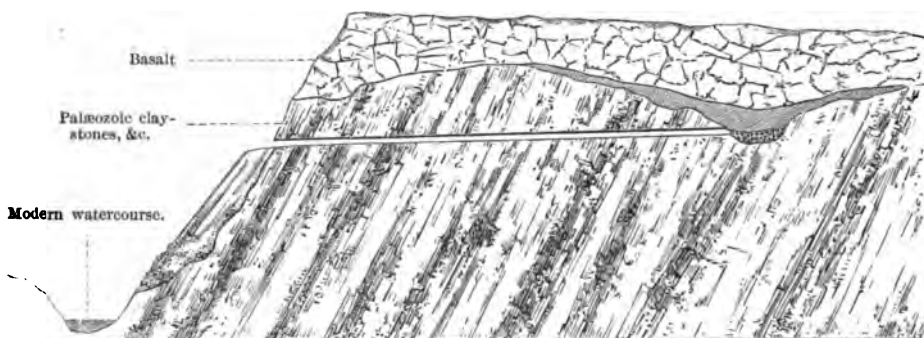
Lakes were formed on the slopes of ridges, currents were diverted into new channels, and excavations made in solid rock, which, but for the great changes effected by the eruption of lava, might have remained intact for ages.

The alterations in the contours due to pluvial action may be traced in part to the great extent of heavily wooded country lying to the south, on and adjacent to the Main Spur, where rain falls throughout the greater part of the year.

The streams fed from this source have cut deeply into the basalts and palæozoic claystones; and instead of looking for gutters far below the surface we have to search for them, as in California and New Zealand, in the bounding ranges.

Figures No. 34 and 35 show the modes of occurrence of deep leads over the greater part of the division, but near Wombat Hill other phenomena present themselves.

FIG. 34.



SKETCH SECTION, SHOWING A LEAD IN THE DAYLESFORD DIVISION.

In the claim of Green and party, at Wombat Hill, a pipe or dyke of basalt was met with which puzzled the miners a good deal. Believing that it resembled an ordinary cliff they sank downwards for about 140 feet, but found no bottom; and they afterwards drove through it and discovered the gutter on the other side. The dyke, according to the sketch furnished by Mr. Sircom, the mining surveyor, is about fifty feet in thickness. (See plan and section.) The overlying basalt is of considerable thickness, and if the miners at this point really touched and penetrated the outlet of the ancient crater their operations certainly deserve more attention than has been given to them. It would appear that the neighboring auriferous stratum and adjacent rocks were not much (if at all) disturbed by the volcanic outburst—a circumstance not easily reconcilable with ideas commonly entertained in regard to such occurrences, but quite in accordance with theory and observed facts.

From a report furnished by Mr. Sircom, it appears that the shaft shown on the section was sunk to a depth of 130 feet, and that the strata penetrated consisted of surface soil ten feet, basalt eighty feet, and slate (silurian) forty feet. The

miners then opened out, and having driven 390 feet due east, were stopped by the basaltic dyke which runs south-easterly. They sank 170 feet along the western edge, but finding no termination of the column, they continued the original drive south-easterly and found the gutter, which abruptly terminated at the edge of the dyke.

In the meantime another shaft had been sunk and opened out and gold got, the lead trending in the direction of the dyke.

The miners in No. 1 shaft then drove through the dyke of basalt from the original level, and found the lead on the northern side at a slightly lower level than on the southern side, the lead dipping much to the northward.

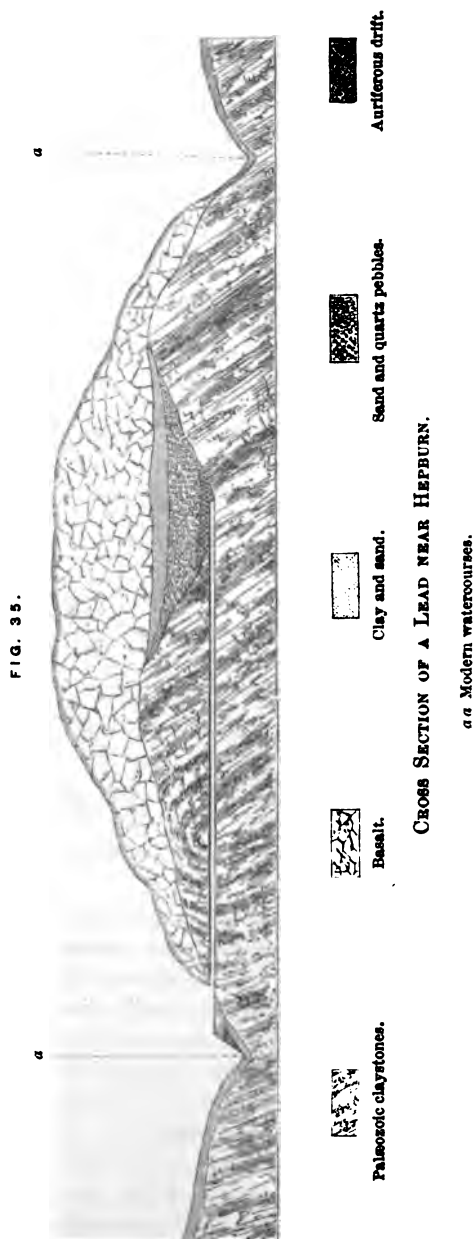
There are quantities of fossil wood, some of the logs being six inches in diameter, and some specimens of melanterite in the black clay overlying the wash in the Wombat Lead.

The drift overlying the black clay contained gold in quantities sufficient to remunerate the miner.

The basaltic dyke was not so hard in the centre as at the sides, and, it is said, calcined slate, boulders, and lignite (half burnt) were found in it.

The phenomena presented in this locality were not investigated when the drives were open, and when the works were in operation; and it is probable that no more information than is given here will ever be obtained.

Some years ago, several surveys of the Daylesford Division were made by the mining surveyor, and the plans furnished by him are of great interest. They show the contour lines, the modern streams, the areas occupied by schists and basalt, the course of the deep leads, and the position and direction of the tunnels; and they appeared to me so valuable that I reduced them to a scale of eight chains to one inch, in the hope that the map might be published; but for departmental reasons the scheme was abandoned, and the M.S. plan now remains in the office not quite completed.



It is not possible to describe in words what is clearly shown by this map, because the leads are tortuous, the recent denudations extensive, and the outline of the country very intricate.

The deep leads at Daylesford give profitable employment to a large number of miners, and a great extent of country is yet open to them.

Neither from the maps nor from other official records is it possible to give any very intelligible description of the leads in the vicinity of Taradale and Malmsbury. The modern streams have cut so deeply into the rocks that the original lines of drainage are almost obliterated; and it would appear that the Coliban River—quite a feature in the geography of the district—is geologically but of modern date. From the ranges of palæozoic sandstones and claystones lying to the west, the gullies (in their lower parts forming leads which trend under the basalt) take a course which would suggest that the ancient channel of drainage lay far to the eastward. One lead, lying to the east of Taradale, runs southwards (in a direction contrary to that of the river); and another lead, traced southwards from the town boundary, runs for the greater distance southwards, and appears thenceforward to trend eastwards. Other smaller leads, having their sources in the range, run eastward towards the latter. The direction of the Scorpion Lead and the Belltopper Lead has not yet been ascertained. It has been suggested that they form a junction at a point north-west of Malmsbury; but from the experience gained by the miners at Ballarat, it seems to me to be premature to offer speculations which may be groundless, and which may seriously affect explorations based on views exactly contrary.

The mining surveyor (Mr. Archdall) has shown a sincere desire to give accurate information respecting this area, but because of the peculiarities of the country, and the comparatively few opportunities he has had of connecting by surveys and levels the explorations made by one company with those of another, he is not able to show the trend of the gutters for any great distance.

Respecting the leads in the lower part of the Coliban, there is not much information available. It is sufficient to say that wherever a basaltic capping is found, the drift underneath is more or less auriferous.

Mr. Hugh Glass, who has valuable mines on his property at Taradale and Lauriston, has caused his agent to furnish some information relative to his operations.

The Allandale Estate Gold Mining Company have three shafts, about four miles in a north-westerly direction from Malmsbury.

In the No. 1 shaft, the strata sunk through were as follows:—

	Feet	in.
Surface soil - - - - -	1	0
Clay, with fragments of quartz - - - - -	6	0
Quartz gravel - - - - -	13	0
Total depth - - - - -	20	0

The bottom is pipeclay; the width of the gutter varies from six to eight feet; the thickness of washdirt from one to three feet; and the yield of gold from 1 dw. to 1½ dw. per load. The washdirt consists of quartz boulders, clay, and sand, and a portion of the pipeclay bottom; and the gold is coarse and not much water-worn. The fall of the gutter is three feet in every 100 feet.

In No. 2 shaft, about thirty chains from No. 1 shaft, the sinking is as follows :—

	Feet	in.
Black surface soil - - - - -	0	9
Clay, with quartz gravel - - - - -	10	0
Basalt - - - - -	48	0
Stiff clay - - - - -	8	0
Quartz drift - - - - -	2	0
Washdirt (quartz gravel) - - - from 9 inches to	2	0
Total depth - - - - -	70	9

The width of the gutter is about fifty feet, and the yield is 5 dwts. per ton.

Ferruginous cement is met with in some places in the drives. The gold is coarse; sometimes pieces weighing 3 and 4 dwts. are found, and none of them are much water-worn. The fall of the gutter is the same as in No. 1 shaft.

In No. 3 shaft, which is situated thirty-six chains east of No. 2, the section is thus described :—

	Feet	in.
Black surface soil - - - - -	2	0
Clay, intermixed with quartz - - - - -	7	0
Basalt - - - - -	52	0
Stiff black clay - - - - -	9	0
Quartz drift - - - - -	3	0
Washdirt - - - - - from 8 inches to	3	0
Total depth - - - - -	76	0

The width of the gutter has not yet been ascertained, but it has been explored to the extent of 200 feet. The yield has averaged 6 dwts. per load. The gold is coarse, and some pieces weigh as much as 16 dwts. The ground is very wet, and the fall of the gutter is the same as in No. 1 shaft.

No fossil wood or other organic remains have been found in these drifts.

The machinery consists of two horizontal engines. One of twenty-five horse-power drives two puddling-mills, and the other, of fourteen horse-power, raises two iron tanks, of 120 gallons each, and the washdirt.

The total length of drives is 4,360 feet, and the course of the gutter is east and west.

The three shafts were sunk on the supposed course of a lead which takes its rise from a gully known as Wattle Gully. This gully has been paying in some places very well for a distance of two miles, and some few men are still making wages by working it. Quartz reefs crop out in various places. One is seen about 300 yards south of No. 3 shaft, and another to the north of No. 2 shaft, but no gold has been seen in them. Three small tributary leads have been found—two to the north and one to the south of No. 3 shaft—and these have been traced up to the line where the basaltic rock overlies the silurian strata.

Gold, in the proportion of 2 dwts. per load, has also been got in the adjoining paddock (Johnson's), on the supposed course of the same lead towards the east, the depth of sinking being about thirty feet, and altogether through clay and drift, basalt being absent. The difference in the height of surface between this point and the site of the No. 3 shaft is considerable.

Tanks and reservoirs have been constructed for supplying water.

The shafts of the Lauriston Company, in the Government Reserve, have cut this section :—

	Feet	In.
Black soil - - - - -	6	0
Basalt - - - - -	80	0
Stiff clay - - - - -	68	0
Drift - - - - -	6	0
Coarse pebbly wash - - - - -	3	0
Total depth - - - - -	163	0

The width of the gutter is about twenty feet, and the yield is 15 dwts. per load ; the gold being not much water-worn.

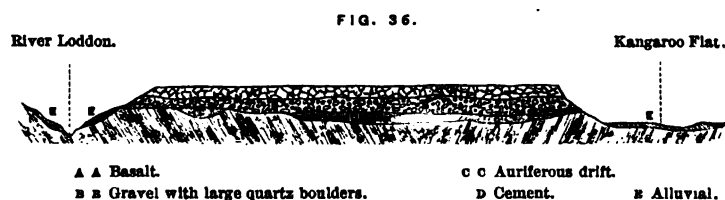
The quartz is mixed with loose pieces of sandstone and slate.

No fossil wood has been found.

This lead, after running some distance in an easterly direction, takes a turn towards the north. It has been traced for a distance of 200 feet from the No. 2 shaft of this company, and further eastwards by the Hit-or-Miss Company, but without success. They made a drive of 1,080 feet in length.

All this information has been communicated by Mr. Glass, and it is to be regretted that similar details are not obtainable respecting other mines in this district. The companies, I have no doubt, would cheerfully contribute facts, but the time at my disposal at present does not admit of my communicating with them, even if I knew where to apply with success.

At Vaughan, near the junction of Fryer's Creek and the River Loddon, the auriferous drifts occur as shown in Figure 36.



Under the patch of basalt which lies north of the River Loddon and west of Campbell's Creek, there are deep leads, but they have not been explored.

If the deep leads and quartz reefs of this district do not present such temptations as would lead to the investment of large sums in mining operations, and if by contrast they appear less attractive than the mines at Ballaarat and Sandhurst, it is yet unquestionable that for miners of small capital there is no part of the colony where they can invest their money and give their labour with less risk, and more certainty of moderate gains, than in the mining district of Castlemaine.

The descriptions of the gold-workings which have been given and the sections show that the difficulties of exploration are few and comparatively insignificant, and that the washdirt, if not very rich, is everywhere of such a character as to give reasonably good returns.

If we cannot expect such large yields as are commonly obtained at Ballaarat, we may yet hope to see many small companies of miners reaping fair profits both from the veins and the alluviums.

A description of the deep leads in the Ararat District will occupy only a small space.

About thirty miles west of Creswick there is a mass of palæozoic rock, about twelve miles in length and five miles in breadth, entirely surrounded by basaltic plains and hills. The axis of the range, which rises like an island in the sea of volcanic matter, runs nearly north and south, and ridges at right angles to it are thrown off both on the east and on the west. Between each ridge there is a gully trending towards the basaltic lava. The Trewalla Creek drains the country on the east; and the goldfield is generally known as Raglan or Beaufort.

There is unfortunately but little interesting information available respecting the physical character and geology of this area.

The main lead appears to run nearly parallel to the range, and to lie about sixty chains to the west of it. Its course is nearly south, and at the north end the auriferous drift is found on the surface, and at the lowest point towards the plains at a depth of 130 feet. The thickness of the washdirt varies from one foot six inches to five feet, and the width of the gutter is about 198 feet.

There is another lead parallel to the range lying to the east, which appears to have been followed for a considerable distance southwards, but nothing certain is known respecting it. It is supposed to be valuable, because on some claims there has been a large expenditure; but for all practical purposes the character of it is unknown to the public. The department has made every effort to get information from the local officer, but without any valuable result.

These leads will probably be traced southwards towards the Emu Creek; and will ultimately be connected with the network of gold workings which extends from the south-western part of Ballaarat, and the north-western part of Smythesdale.

Little is known respecting the character of the washdirt, except that the gold contained in it is generally coarse, and that moderately large nuggets are frequently found. Some of the auriferous drifts have given 1 oz. to the load; and nuggets, varying in weight from 16 ozs. to 30 ozs., have been taken out of the headings. It has been estimated that about 75 per cent. of the gold got in these leads is in pieces varying in weight from 1 dwt. to 6 ozs.

There are, as already stated, two main leads in this division, and about twenty tributaries; and as the lower gold workings trend towards a hollow or valley separating the palæozoic area of Carngham from that of Raglan, it is somewhat disappointing to have to state that the available information respecting them is so meagre.

The miners to whose labors we owe so much will in due time explore this area, and make known its character and resources.

All the gold workings at Ararat, which follow the trend of the valley of the River Hopkins and its tributaries, will ultimately be traced southwards, and will probably be found to unite at some point near the junction of the Deenigul Creek and the River Hopkins.

The Wet Lead will be followed along the bed of the Branch Creek into the Black Lead, which will conform to the course of the Hopkins.

As far as they have been explored the leads present good prospects. The sinking is not very deep, and on the whole the strata are not difficult to penetrate; but in some parts there is a good deal of water to contend with, necessitating the erection of powerful machines for pumping.

The great number of rich gullies emptying into the main channels make it probable that good results will follow the introduction of capital into this district. Up

to the present time there have been but few successful attempts made to develop the leads, and as far as I am aware the miners have not endeavoured to ascertain by borings the course of the southern extension of the principal lead.

Mr. Geo. B. McAlpine, who has a thorough knowledge of the character of the deep leads at Ararat, and who by reason of having occupied a prominent position in the local Mining Board for many years, is able to speak with authority on all matters connected with mining operations in his district, has, at my request, prepared a report on the results of some of the operations of the Deep Lead Companies at Ararat. He has also furnished a plan, showing the course of the leads as actually explored, and the supposed trend of them. According to the plan it would appear that the Wet Lead (in its lower part called the Caledonian) will unite with the Black Lead, near the point where the latter is touched by Branch Creek.

The Caledonian Lead is fed by the Hard Hill Lead, the Flint Hill Lead, and the Upper Wet Lead; the lowest point explored on the latter showing the depth of the gutter to be eighty feet.

The upper feeders of the Black Lead are Canton, Duchess of Kent, Camp, Oliver's Leads, and others. After crossing the line of the River Hopkins, the Black Lead appears to take a course towards the south, its bed lying about a mile, and further south a mile and three-quarters, east of the river.

It receives the Lushington, Old Korns, Dead Chinaman's, and Hopkins Leads, from the west.

At the junction of the Lushington, and Old Korns, the sinking was eighty feet; and at the Dead Chinaman's and Hopkins, forty feet.

Mr. McAlpine says:—"The plan of the Black Lead Company's claim shows the relative positions of the tributary leads on the eastern side of the Ararat Range. On the western side are three principal leads, namely, White Lead, Blackman's Lead, and Spring Lead, all tributary to a deep lead, which is supposed to run parallel to the Deenigul Creek.

"All these leads, with perhaps ten times the number of intervening smaller leads and patches of alluvium, constitute the shallow workings on the Ararat Goldfield.

"The figures on the plan which I have furnished, show the depths of the sinking on each lead where the workings left off, and where the water began to be troublesome. None of the leads have run out; they have ceased to pay for the present, because the washdirt is thin, and the quantity of water excessive.

"Only three, the Upper Wet Lead, Commissioner's Hill Lead, and the Black Lead, have engines at work on them.

"The only leads deserving the name of deep leads are the Commissioner's Hill Lead (in its lower part), and the Black Lead; and both of these are in the Black Lead Company's claim.

"The Britannia shaft is sunk on the edge of the basaltic formation which lies to the east of the River Hopkins and extends southwards for many miles, and is 152 feet in depth. The bottom is the ordinary silurian clayslate; and the gold got from the washdirt is fine, angular, and of a dull color.*

"The Old Britannia Company got 3,000 ozs. of gold from the claim before they transferred it to the new company. The present proprietors have sunk the shaft

* Much of the gold got in this and the neighbouring district towards the north, is associated with black oxyd of manganese, and oxyd of iron.

fifty feet through the bed-rock, and are at present driving for the gutter. The washdirt is from three to six feet in thickness, and the gutter about forty feet wide.

"The Old Lead (Commissioner's Hill) had two distinct runs of gold. The lower run was comparatively fine, water-worn, and bright; and the upper, about thirty feet higher, on a sloping bottom, shelving into the deep ground, showed coarse gold in many instances coated with oxyd of iron, such as the miners call 'black gold.'

"Several pieces of fossil wood have been found in the lower drift. I enclose specimens—portions of a log taken from the drift at a depth of 152 feet from the surface, and 101 feet below the bluestone rock. The larger piece is taken from the outside of the log, and the smaller piece from the heart or middle of it.*

"The Black Lead shaft is only ninety-two feet down. The bore close by is bottomed at 182 feet.

"The several strata gone through are as follows:—

	Feet	in.
Clay - - - - -	11	0
Basaltic rock - - - - -	28	0
Red clay - - - - -	8	0
Black clay (extremely light) - - - - -	15	0
Basaltic rock - - - - -	92	0
Black clay - - - - -	3	0
Green stuff, like reef - - - - -	9	0
Sandy fine drift - - - - -	4	0
Basaltic rock - - - - -	12	0
Total depth - - - - -	182	0

"The strata found in the bores, No. 1 and No. 2, about a mile and a-half to the south, are thus described:—

No. 1.

	Feet	in.
Surface soil - - - - -	9	0
Rotten basalt - - - - -	20	0
Massive blocks of basalt - - - - -	14	0
Red sandy clay - - - - -	8	0
Basaltic rock - - - - -	51	0
Gravel and clay - - - - -	13	0
Total depth - - - - -	115	0

No. 2

(940 feet east of No. 1).

	Feet	in.
Basaltic rock - - - - -	36	0
Red clay - - - - -	6	0
Basaltic rock - - - - -	59	0
Clay - - - - -	4	0
Total depth - - - - -	105	0

* The outer portion is in good preservation, and resembles the wood of a tree but slightly decayed; it is bright, silky, and of a reddish-brown color. The inner part is mineralized, and the iron pyrites contained in it has decomposed on the surface. It no doubt contains gold.

"In the third bore, about 1,000 feet east of the No. 2 bore, the strata were found arranged in the same order as in No. 2 bore; and the total depth, through the two basaltic rocks, with the two strata of clay intervening, was found to be ninety-three feet.

"The engine at the Black Lead Company's shaft is sixty-seven horse-power; and 1,400 gallons of water per minute are thrown out by two lifts, the pipes being respectively eighteen inches and twelve inches in diameter. The great body of water comes through the fissures in the second basaltic rock.

"With regard to the Deenigul Creek, I can only state that the ground, at its junction with the River Hopkins, has not been proved in any way, but four shafts have been sunk about a mile higher up on the creek. The first shaft bottomed—that of the Junction Lead Company—touched washdirt, and 1 oz. 16 dwts. of gold were taken off the bottom. Eventually, this company and three others had to cease working, owing to the washdirt being thin, the driving hard, and the water heavy, necessitating the employment of steam-power to overcome it. The gold obtained was coarse and dark, and the sinking was from sixty to seventy feet.

"This brief sketch will show that our deep leads are, for all practical purposes, undeveloped. The Black Lead Company is simply a prospecting company. Up to the present time they have expended £12,000, and as much more will be required before the lead is fairly opened.

"It is very evident, from the geological formation of the Ararat goldfield, that the ancient valley or outlet (there may be many of them) lies under the basaltic rock, which extends many miles to the southward; and, from the strata which have been penetrated, and other indications, it is apparent that the formation resembles that of Ballaarat; and I see no reason to doubt that we shall find as good leads at Ararat as are found near the sources of the Yarrowee. But, unfortunately, we have not sufficient capital to develop them."

The creek which flows westward of Campbell's Section, towards Moyston, has not been properly explored. There are numerous patches of auriferous earth on all its tributaries, and a deep lead will be found towards the south, but of what character it is impossible to say. Whether continuous or broken by denudation, the old gravel, wherever it is found, will certainly repay the miner, if the character of the recent drifts may be taken as a guide.

The gold workings on the tributaries of the Concongella Creek have been traced northwards for some distance, and a reasonable prospect of success is before the prospector in explorations beyond the Great Western Lead. The ancient bed of the Concongella will, probably, more nearly resemble the deep leads at Sandhurst than those of Ballaarat, or Raglan, or Ararat.

All the country south of the Wimmera, from Crowlands to Rose's Gap, is a goldfield, and both shallow alluviums and deep leads will be found in it. At Emu Flat, about three miles west of Landsborough, a lead has been traced for a considerable distance. It is tortuous, the sinking is somewhat difficult, and in places is as deep as 100 feet (mostly through hard cement), but the bottom is dry, and the gold coarse and nuggety. The yields vary from 4 dwts. to 3 ozs. per load.*

The following description of the deep leads at Pleasant Creek has been prepared by the Chief Mining Surveyor (Captain Couchman), to whom I am indebted, also, for

* *Mining Surveyors' Reports*, p. 81—December, 1865.

the excellent plans and sections which illustrate his paper. He has visited this goldfield, and is well acquainted with the character of it:—

“On the goldfields of Victoria it is usual to find by far the greatest portion of the alluvial gold in the existing valleys and surface depressions, unless by volcanic agencies the schist-rock formations, on which the auriferous drifts occur, have been covered up by overflows of basalt. In such cases the modern watercourses are almost certain not to be coincident with the older valleys below the basalt; except, perhaps, as regards the general direction of the drainage. The rule, however, does not hold good with respect to the auriferous deposits at Pleasant Creek. The country there is quite free from the effects of volcanic eruption, and yet these deposits have been, for the most part, found under the existing hills and elevated surfaces; the modern valleys and flats being generally either non-auriferous or too poor to pay for working, for the gold they contain.

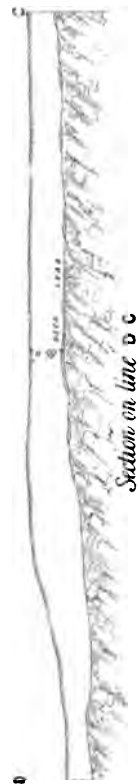
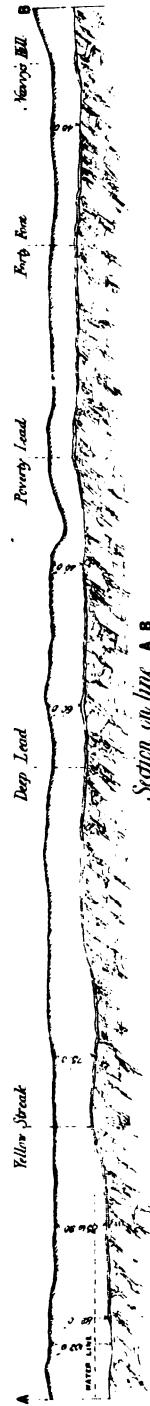
“Nearly the whole of the alluvial workings on this goldfield are comprised in the Deep Lead and its tributaries, situated from three to five miles north-west of the township of Stawell, and the Commercial-street Lead and its probable tributaries, commencing at the Quartz Reefs, about one mile north and north-east of Stawell, and terminating at the Seventy-foot Hill, about three miles west of that township.

“With respect to the Deep Lead, Mr. D’Alton, the Government local mining surveyor, reports that it was the richest in the division—the yield of gold in the washdirt often exceeded 72 ozs. to the load. The gold was water-worn and fine—the largest pieces seldom reached a pennyweight—and that obtained from the cement was exceedingly fine in quality. The rich washdirt varied from 120 to 460 feet in width along the leads, and it was from two to eight feet in depth. The cement is still being worked with profitable results.

“The Deep Lead appears to have derived its supply of gold chiefly from two tributaries, the principal one coming in from the eastward by way of Navy’s Hill, Forty-foot and Poverty Leads; this tributary probably received supplies of auriferous drift also from old gullies draining into it from the south-east from the direction of Nuggety Hill, German, Haver’s, and Carney’s Gullies, but now worn away by the scouring action of the more recent drifts along the course of Welshman’s Flat. The other tributary from the north-east, which joins the lead near the Yellow Streak, may have been an outlet for some of the auriferous drifts from the Four-posts. It is said the latter diggings did not show any indications of a defined lead—the payable gold was found in detached patches, spread over a wide fiat surface.

“The runs of gold in the Deep Lead and its tributaries do not conform to the existing surface lines of drainage, which trend from the Four-posts southward to the Welshman’s Flat, and thence along that valley to the westward; but from the Four-posts they have been traced through flat, but slightly elevated country, rising on the surface, to the Deep Lead; and from Navy’s Hill to the same point they lie in detached patches, under the edges of a series of low made-hills, up to the commencement of the Deep Lead; and from that point they have been traced continuously in a north-westerly direction, through elevated country, similar to that from the Four-posts, until they terminate in deposits of very fine water-worn gold, near the point marked A on the plan.*

* “In auriferous leads it almost always follows that nuggets of the largest size, and showing the greatest difference in form and weight, are found deposited in the tributaries, or near the supposed sources of supply; and as the leads die out for want of feeders, that the gold becomes



"The hills and flats in which the auriferous drifts occur are composed of tertiary deposits, consisting of beds of clay, gravel, and sand, and patches of ferruginous cement; the latter formed by water containing iron in solution percolating through some of the porous shingle beds. The fine gold found in this cement is probably due to the cement having presented a hard compact bed for its lodgment. The tertiary deposits vary in depth from forty-five feet at the upper end of the leads to upwards of 100 at the lower extremity, so that the levels of the bed-rock on which the gold has been found exhibit the well-defined fall of an ordinary water channel from end to end, although the deposits may not in every instance occupy the lowest depressions.

"It is evident, from the great depths of the tertiary drifts, that large deposits of *detritus*, the result of the disintegration and denudation of the rock surfaces at higher levels, have been made in this locality; and the accumulation of these deposits has no doubt been greatly assisted by the low rate of inclination of the old drainage beds to the westward. Assuming, therefore, that the lines of the Deep Lead and its tributaries represent the sites of the earliest watercourses, I am of opinion that the latter were gradually changed, and the bed-rock in some instances deepened in other directions, by some of the agencies I have already described in a paper relative to similar changes in the drainage courses of the Mount Alexander Goldfield; that afterwards the alluvial deposits not only silted up the older valleys, but also covered up many of the hills of small elevation in the vicinity, and formed wide flats composed of drifts of the later tertiary period. Newer valleys of erosion appear then to have been formed in these drifts, often cutting across the leads of gold, causing the present surfaces to take the form of hills, where valleys originally existed. The fineness of the gold found in these leads will probably account for the patchy character of the deposits, as the latter would be liable to easy removal by the scouring action of non-auriferous drifts of the newer pliocene age, brought down by watercourses intersecting the courses of the leads, in some of the geological changes that have taken place in the long ages of the tertiary period.

"The accompanying sketch-plan shows the extent of the gold-workings in the Deep Lead and its tributaries; and the sketch section, the approximate inclination of the bed-rock along the section lines, A B and C D, shown on the plan.

"In referring to the Commercial-street Lead and its continuation, which come next in importance, the local mining surveyor says that the lead chiefly occupies what at the present time are slightly elevated ridges; and where small gullies intersect the course of the lead the ground is always poor and patchy as regards the auriferous deposits, and in some cases entirely blank. The gold is fine, and mixed with magnetic black sand. The run of rich washdirt varies from 120 to 460 feet in breadth, and from

very fine, and devoid of nuggets of even the ordinary size, as appears to be the case in the leads at Pleasant Creek. This peculiarity in the character of the auriferous deposits seems to me to afford an argument against the theory recently put forward: that nuggets have been formed, or increased in size, around particles possessing favorable conditions, as nuclei, by the action of meteoric waters. Many of the very small particles of gold found near the termination of leads must have been equally subject to the action of meteoric waters, and probably to conditions just as favorable to their proportionate development as the nuggets found nearer the heads of the leads, where they have sometimes varied in weight from many pounds down to much less than a pennyweight. I desire to avoid the expression of any decided opinion against the ingenious theory I have referred to, but it occurs to me that, if it be correct, the gold usually deposited at the termination of leads ought to present a greater difference in the form and weight of the particles, and to contain a due proportion of nuggets.—T.C."

two to eight feet in thickness. The cement found in the drifts also contains gold, and, as in the case of the Deep Lead, the auriferous deposits do not always occupy the lowest levels of the schist rock—their beds being rather higher than the rock on either side. The run of gold is very irregular in direction; but this appears to have been chiefly caused by the hard ledges of rock which intersect the course of the lead.

"In the vicinity of the Quartz Reefs there are several leads of very limited extent, all of which are lost on reaching the flat country. The most remarkable of these is in Taylor's Gully, as the lead at this place has been traced from an outcrop on the surface, in one continuous line, through Church's Hill, down the gully in question, as shown on the plan of the locality and sketch section herewith. The depth of the washdirt ranged from eight to fourteen feet, and the gold was coarse and nuggety.

"Judging from the appearance of the country, it is, I think, extremely probable that the Commercial-street lead of gold through the Silver Shilling, Forty-foot, Fifty-foot, and Seventy-foot Hills, was derived mainly from the sources of supply afforded by the disintegration of the rich quartz lodes, situated within, or to the east of the Reefs township, near Stawell, and that the original course of one of the feeders, passed along in the direction of St. George's Lead, through Church's Hill and Taylor's Gully, and thence across the Pleasant Creek Valley into the Hard Hill or Silver Shilling, as indicated by the section lines from A to B on plan. This view is, in my opinion, strongly supported by the peculiar outcrop of the lead on the northern slope of Taylor's Hill. It appears only reasonable to assume that this outcrop is simply the break of an old lead, deposited in a valley or channel, at a much higher level than the existing St. George's Lead, and originally connected with some point near the present surface auriferous alluviums near the Cross Reef. It is further supported by the great inclination of the old rock surfaces from the quartz lodes at the Big Hill downwards to the Hard Hill, and also by the fact that the alluvial gold deposited near the supposed source of supply was very much coarser and larger than that found in the more distant lead, as would naturally be the case if my supposition be correct.

"At the present time the fall of the bed-rock from the Big Hill to the Hard Hill is said to be about 250 feet in about one and a-half miles; it must, however, have been much greater before the Big Hill Range was so much reduced in height by denudation.

"The existing depressions in the gully at the lower end of St. George's Lead, and in the Pleasant Creek Valley on the section line, are probably due to the eroding action of new water channels, which crossed the old lead at right-angles, as they do now, and deepened the original bed-rock surface, diverting the course of the auriferous deposits from the Reefs, in a westerly direction from the end of St. George's Lead, as shown on the plan of locality; while in the new valley of Pleasant Creek the denuding agencies of the newer pliocene period seem to have carried away and obliterated all traces of the fine gold which lay on what I suppose to have been the line of the old lead, and left deposits of non-auriferous drift in its place.

"The discrepancies in the positions of the old lead and the modern valleys are no doubt due to the same causes that have been in operation at the Deep Lead and its tributaries, so that they need not be further described here. It is, however, very remarkable that the western end of the Commercial-street Lead underlies, for a considerable distance, the summit of a made hill, lying directly between two modern valleys.

"Since writing the above paper I have received from Mr. D'Alton, the local mining surveyor, the following interesting information relative to the character of the washdirt found in the Pleasant Creek Leads.

"In St. George's Lead the washdirt is of a reddish-brown color, and contains angular pieces of quartz, small fragments of schist rock, and red cement. The gold is not water-worn.

"At Church's Hill the gold is found in hard cement; it is nuggety and not much water-worn.

"In Taylor's Gully the washdirt contains angular pieces of quartz, fragments of cement and schist rock, and the gold is rather fine, and not much water-worn.

"At the Hard Hill and Silver Shilling, the washdirt is of a light-brown color at the east end of the ground, and it becomes white towards the western end. It contains some angular quartz pebbles and large rounded quartz boulders, and small fragments of cement. The gold is not much water-worn.

"In the Forty and Fifty-foot Hills, the washdirt is of a white color, and it contains both water-worn and angular quartz, and magnetic black sand. The gold is moderately water-worn.

"In the Seventy-foot Hill the washdirt is of a yellowish-brown color, and contains angular quartz pebbles, fragments of cemented quartz and magnetic black sand. The gold is not water-worn.

"At Four-posts the washdirt is of a light-yellow color, with patches of cement and moderately rounded quartz pebbles. The gold is water-worn where it occurs in the washdirt, but it is not water-worn in the cement.

"At Nuggety and Doctor's Hills there is light-brown washdirt, with fragments of sub-angular quartz and cement; the gold is large, and not much water-worn.

"In German Gully the washdirt is of white color, and it contains slightly rounded quartz pebbles, and the gold is large and not much water-worn.

"In Haver's and Carney's Gullies the washdirt consists of a fine-grained soft white cement, and the gold is not water-worn.

"At Navy's Hill and Forty-foot the washdirt is of a white color, and is interspersed with patches of cement. It contains slightly rounded quartz pebbles, and the gold is but little water-worn.

"Poverty Lead principally contains cement. There is a little washdirt of a white color, which is nearly as fine as sand, and the gold is slightly water-worn.

"The washdirt in the Deep Lead is of a white color, and it contains at the eastern end of the ground much-rounded quartz pebbles. It changes in many places to the westward to a 'wash' of exceeding fineness, like pulverized quartz, with lumps of black oxyd of manganese. It is also traversed by bands of a bright yellow color, which gave rise to the name of the 'Yellow Streak.' This fine washdirt is peculiar to the Deep Lead. The gold is water-worn and very small.

"There are two or three kinds of cement in the Deep Lead; in one the quartz pebbles are quite sharp and angular, and in another they are rounded and water-worn.

"Fossil trees and shells are said to have been found in the Deep Lead. The mining surveyor was informed by one party, in whose claim a large tree was found, that it was lying on the bed-rock, at a depth of eighty feet from the surface, and encased in the hardest cement."



Tunnelling.



The miners in the Daylesford District have constructed tunnels for the purpose of obtaining washdirt from the *leads* in all those places where the beds of the modern streams are below the level of the gutters. This method of working the leads by horizontal shafts is economical in most cases, but not always. Some of the tunnels near Daylesford are more than 3,000 feet in length, and, having regard to the costs of mining and timbering, it is questionable whether a perpendicular shaft sunk over the gutter would not better serve the purpose.

In 1858 I suggested, in a report which was laid before Parliament, that a great deal of labor would be saved, and many useful ends gained, by an amalgamation of adjacent claims, and the construction of one main tunnel, with cross drives; but the suggestion, as far as I am aware, was not favorably received by the miners. A number of tunnels parallel to one another and close together—all driven to reach the same gutter—appeared to me to indicate exclusiveness and jealousy, and it was as much for the purpose of breaking down barriers that operated disadvantageously to the interests of the miners, as for the sake of economy, that I advised the plan of one main tunnel for the use of adjacent claims.

It appears from Mr. Hittell's work that this system of main tunnels is common in California, and has worked well.*

Tunnels are constructed not only to penetrate the alluviums but also the veins. Very extensive works of this kind have been undertaken in the Beechworth and Gippsland Districts; and one tunnel, of more than ordinary importance, has been commenced at Maldon, for the purpose of cutting and working the auriferous veins which intersect Mount Tarrangower. The miners who have undertaken this work have introduced boring machines, somewhat similar to those used in the construction of the Mont Cenis Tunnel, but with what beneficial results I am unable to say.

A boring machine has recently been invented by Mr. R. G. Ford, of Sandhurst, which promises to be of great use in mining operations. According to a statement made by Mr. Joseph Millin, the manager of the Hustler's Reef Company, at Sandhurst, the saving effected by the use of this machine is considerable. In a letter now before me, he says that "drilling in ground that would cost forty shillings per foot with hand labor, can be wrought with the machine for thirty shillings—or if with hand labor at sixty shillings or eighty shillings, with the machine for forty shillings, or from forty-five or fifty shillings per foot. In other words, the harder the ground, the greater would be the saving effected by the use of the new borer." This is valuable

* *The Resources of California*, by John S. Hittell, 1866, p. 267.

testimony from a practical miner. The invention is undoubtedly of great merit; and it is to be hoped that it will be brought to a state of completeness, and be largely employed in driving and sinking.*

* Mr. Ford's machine is thus described by the inventor:—"In Ford's rock-boring machine the motion of the boring-tool is reciprocating, and the motive-power is compressed air or steam at a pressure of 60 lbs. per square inch, acting on a piston in a cylinder. It presses constantly on a small annular space in front of the piston, and intermittently on the whole area of the back of the piston; a percussive action is thus given to the borer carried by the piston-rod. The ports for the alternate admission of the compressed air behind the piston and for the exhaust are opened and closed by a valve worked by a small piston, thus securing the full pressure on the back of the piston, and giving a free blow and a clear exhaust for the return stroke.

"The air ports and the movement of the valve are so arranged that the piston cannot strike the front and back of the cylinder. The rotation of the boring-tool is self-acting, and is caused by the piston-rod working a ratchet and click round a cylinder attached to the front of the working cylinder; and as the piston reciprocates, it carries itself round the cylinder, and makes a complete revolution every twenty-one blows, by which means the machine bores a perfectly round hole, and the drill cannot move more or less than a twenty-first part of a revolution at each stroke. The feed is self-advancing and self-adjustable and variable, feeding with precision as fast as the tool has power to penetrate the rock, but no faster, varying its feed in the same hole with the varying hardness of the rock, or sharpness of the tool. This is effected by the working cylinder being provided with an exterior cylinder in which it can slide, and the compressed air is constantly tending to propel the working cylinder forward, but is retained by a screw, which is prevented from turning by a pawl, which the piston strikes when it makes a full stroke, thus releasing the screw, and permitting the working cylinder to advance forward as the hole increases in depth.

"The air compressor for supplying the boring machine at present in use at the Hustler's Reef Company's mine, at Sandhurst, is of simple construction and very effective, having two legs of nine inches diameter resembling in shape the letter U, one side being provided with a piston having a two-foot stroke, and the other with water; thus, as the piston moves up and down in one leg, the water rises and falls in the other, which makes it double-acting. The inlet and outlet valves are placed at the top of each leg, which are provided with jets of water; and at each stroke a small quantity of water is admitted through the inlet valve, and returned to the receiver through the outlet valve at each return stroke. Thus the water circulates through the compressor and the receiver, and carries off the latent heat given off by the air in compression. The piston-rod works through a stuffing-box at the bottom of the U, and is provided with a cross head and fork-connecting rod attached to the crank-pin working the mine pumps at about ten strokes per minute, which is sufficient to supply one boring machine, and the power required is three horse. The air-receiver is an old boiler four feet diameter and thirty feet long, placed on four blocks of wood outside of the engine-house, and is provided with safety valve, pressure gauge, and fifteen inches of water for cooling the air as above described. The air is conveyed in 800 feet of 1½-inch gaspiping to within thirty feet of the boring-machine, thence to the machine through sixty feet of one-inch indiarubber hose, which is provided with a stop-cock for regulating the supply to the machine. The boring-tool is supplied with a jet of water taken from the mine-pump through a half-inch gaspipe, and thence through indiarubber hose, which is provided with stop-cock and brass nozzle. The fixing of the machine is effected in a drive or a tunnel by securing a wooden prop either vertically or horizontally, which is provided with a screw at one end to tighten it. The end of the machine next the prop is provided with a cup and ball, giving the machine all the movements of the human arm, also a radial movement round the prop. Thus holes can be bored at any angle. In open cuttings or quarries the machine can be fixed to the end of a crane jib, by which holes can be bored in any position within the radial movement of the jib; or the machine may be suspended from a travelling crane, and thus command the whole area of a cutting or quarry. In large tunnels two or three machines can be fixed on a truck having vertical cast-iron columns, and provided with arms, by which means the whole face of the roadway can be commanded. An ordinary drill is used; the only alteration required is the head, which is made to fit the machine. The drills can be made to bore holes from ½-inch to two inches in diameter. The weight of the blow struck by the machine can be varied from one pound to 510 pounds, and the number of blows from 20 to 600 per minute, by the attendant simply moving the handle of a small air-cock."

It is impossible to give even an approximate estimate of the cost per yard of tunnelling. The character of the ground, whether wet or dry; the degree of hardness of the rock; the facilities for, or the difficulties in the way of, procuring suitable timber for props and cap-pieces, and slabs (where necessary); all operate to increase or decrease the cost, just as the circumstances are favorable or unfavorable. But in order that some opinion may be formed on this point, I have given in one of the Appendices the rate of wages current on the goldfields. It is scarcely necessary to say that all the work depending on men's labor, and not on machinery, is more costly here than in Europe.

In some of the longer and larger tunnels great cost has been incurred in the erection of machinery for the purpose of ventilation. It is perhaps not right to speak authoritatively where all the facts are not known; but I am inclined to think that some of the contrivances are more costly, and more imposing in appearance, than would have been erected in the older countries, where the arts of mining and ventilating are in some respects better understood.

Ponies are used in some places to draw the trucks; and in many of the well-managed mines in the Beechworth District, there is little that a skilful engineer would wish to see changed.



Quartz Mining.



Wherever the surface of the schist rocks is touched, whether exposed, as at Castlemaine and Bendigo, or hidden under basalt, as at Ballarat, or covered by tertiaries, as at Sebastian and Wahgunyah, we find auriferous veins of quartz. The strata which they intersect are either unaltered or present a low degree of metamorphism. The veins vary in thickness from the sixteenth of an inch to 100 and 150 feet; and some, as thin as the paper on which these words are printed, intersect soft mudstones and sandstones containing palæozoic fossils, and in such a manner as almost to cut the fossils; but the delicate structure of the casts is not altered, nor are any of the interspaces filled with quartz.

In some of the veins we find dense white milky quartz, homogeneous and breaking with almost a hackly fracture; in others, brownish and yellowish quartz, laminated, and resembling jaspery quartz or hornstone, and showing a semi-conchoidal fracture when broken; again, we find veins of laminated quartz, with pyrites and other sulphides intercalated, and pieces of blue slate included in the laminations of the quartz; and in many places quite crystalline quartz, containing crystals of galena, carbonate of copper and iron pyrites, with free gold in the interstices of the crystals and intermixed with the sulphides and carbonates, and occasionally (not often) in the bases of the hexagonal crystals of quartz in moss-like aggregations.*

Not only in the veins, but also in the casing of the veins, does the gold occur in lumps, crystals, and small particles with rugged edges; and in the soft mudstones at Kamarooka, thin plates of gold lie in the planes of bedding of the rock.†

* Five large crystals of quartz, enclosing gold, were exhibited in the Intercolonial Exhibition in Melbourne.

† Nine specimens were exhibited in the Intercolonial Exhibition. They are thus described in the catalogue:—

(a) Two pieces of light-brown mudstone or claystone. Very small thin plates of mica all through the mass. A thin seam, marked, rather than filled by peroxyd of iron, is seen in one specimen. The gold appears to be distributed in thin leaves in the lines of bedding of the rock.

(b) Claystone, harder than *a*, with gold distributed in the same manner.

(c) Similar to *a*. The gold appears to be differently distributed.

(d) Sandstone with crystallized quartz on one face. Fine scales of gold and smaller plates of mica are disseminated through the sandstone.

(e) Sandstone with crystallized quartz on one face. Gold is seen here in the cavities of the quartz.

On examining a line of reef on any goldfield, it is found that at a certain depth below the surface—say 80 or 100 feet or more—a point is reached where water becomes troublesome to the miner. All above this point is dry, all below it is wet; and on examining the quartz above what is called the *water-line* and below it, it is observed that the character of the rock is different.

The water-line generally is very clearly defined.

Above the point to which the waters reach the quartz is dry and harsh, and on breaking it we find free gold in cavities which bear the impress of the minerals which once filled them. Square spaces exactly conforming to the surfaces of cubical pyrites are most common; but in some cases these are almost obliterated by the subsequent deposition of quartz in fine crystals. From the structure of the interior surfaces it is at once obvious that they were formerly occupied by other minerals which have been dissolved and carried to lower depths. Some gold is left in the cavities; but having regard to its mode of occurrence when associated with carbonates of copper and sulphides of lead and other ores, it is reasonable to suppose that all the gold which was once in these spaces has not remained.

Below the water-line the interspaces and cavities are filled with sulphides and carbonates and free gold; but if any portion of the rock taken from a point below the water-line be treated with acids, it assumes the same character and comes to resemble a piece of quartz taken from a point above the water-line.

Whether by operations in the laboratory, or by the slower decomposition due to the access of water and atmospheric air, we get the same result—clean quartz with free gold in the cavities.

But there are reefs cropping out at the surface which are composed almost entirely of iron pyrites, arsenical pyrites, and other sulphides and carbonates, with but little quartz; and it is not easy, at once, to explain the circumstances under which these veins have been conserved. It may be assumed that the occurrence of them is accidental, and that it is due to the dip and strike, and lithological character of the rocks which enclose them. Where the surface drainage is good, and where the sulphides are in a measure protected from those influences which lead to their decomposition, they may remain for long periods unaltered. In some cases such veins maintain their character, because as rapidly as any one constituent is decomposed and carried away it is reproduced and replaced.

That the sulphides may remain unaltered, is proved by the mineral constituents of outlying exposed bosses of granite: on them rain-water may beat, but it never can lodge, and some kinds of pyrites are found in them, which under other circumstances would have been rapidly decomposed. And that the general character of a rock may be maintained, notwithstanding continual changes in its particles, has been proved not more clearly by experiment than by observation of veins and rocks *in situ*.

(f) Part of the wall of a quartz vein; quartz laminated; heavy gold, and very thin scales.

(g) Three pieces of white quartz, stained with iron oxyd in patches, where some mineral has decomposed. Spongy gold in cavities.

(h) Light-brown claystone, with a good deal of very fine mica, and minute thin scales of gold lying apparently everywhere in the lines of bedding. Two or three thin plates of gold are perpendicular to the line of bedding.

(i) Light-brown claystone, with thin plates of gold irregularly disseminated in the mass.

A careful examination of these specimens leads to the inference that the gold was deposited at the time when the rock was formed.

It appears to be necessary to the decomposition of sulphides in nature that they should be fully exposed to moisture and atmospheric air. But it is still difficult, having regard to the position which some of the pyritous reefs occupy, to explain how they should have continued to maintain their specific character through all the changes which have occurred since they were first formed.*

Our quartz veins present to the geologist subjects of investigation of the highest interest. Indeed it is not too much to say that a thorough investigation of them, which would lead to a clear comprehension of the causes involved in their origin and their subsequent modifications, would throw more light on the structure of the crust of the globe than all the information afforded by the palæontologist, important and valuable as it is. While the palæontologist has labored successfully in all the strata, from the lowest, where the indications of organic life are few and faint, to the newest, where the works of man himself mingle with the remains of extinct species, and has turned over, as one may say, leaf after leaf of the book of Nature, and taught us what there may be read, the mineralogist has stopped short in his earliest steps, and is compelled to confess that nothing certain is known relative to the origin of the subjects of his investigation.

The first dawn of life is visible to us; and we may gather from the pages of Forbes, Huxley, and Owen many established facts relative to the external appearance, character, and habits of the earliest lowest forms of life; and by the aid of the labors of these distinguished men we may travel thence upward a vast scale until we reach the highest developments of Nature: and what Science teaches us we may, by diligent study, verify for ourselves; but when we turn from this branch of science to that which is so intimately connected with it—mineralogy—we immediately plunge into a fog of doubts and uncertainties.

Whether, as regards mineral veins, we adopt the theory of Hutton—that of igneous injection, or that of Werner—aqueous deposition, or that of Necker—sublimation, the conversion of solid substances into vapours by heat and their subsequent condensation, or turn to the more practical researches of Mr. Robert Were Fox, and attempt to explain the phenomena presented to us by the agency of currents of electricity, we have innumerable difficulties before us, because not one of them is sufficient to explain satisfactorily all that is observed.

This is not the place, and it is not the object of this paper to discuss theories; but the work would be left imperfect if reference were not made to the opinions and suggestions of practical men who have directed their energies to the elucidation of the modes of deposition of minerals in veins. Some among the more intelligent observers who have examined the quartz reefs of Victoria adopt, without hesitation, the theory of Hutton; others—and many of them are entitled to be heard—have started theories of their own more or less consistent with, or modifications of, the theories of the greater authorities I have named.

* The *water-line* bears a relation to the level of the adjacent streams; and on every line of reef it must at some period have stood higher than it does now.

Where the wearing action has been energetic in the stream beds (due to mountain torrents) and proportionately far greater than on the adjacent hills, the *water-line* has been rapidly lowered; but in other cases, where the stream bed has been raised (as at Sandhurst) by *detritus* brought down from the hills, the *water-line* has, subsequent to this action, either maintained its normal position, or, perhaps, has been slightly elevated.

Is not this suggestive of the true cause of the pyritous reefs being conserved in some places?

A practical miner and an able writer,* who has examined the reefs of the more important goldfields in Victoria, is of opinion that in these veins the distribution of the gold, and the structure and arrangement of the quartz, are explained by the theory that they are fissures which have been filled with molten silica containing entangled metallic vapours; and that the fusion of rocks in the bowels of the earth, and their subsequent consolidation, supply the requisite conditions for the rending open of the superincumbent rocks, and the filling of the rents so formed with fluid matter, varying in composition according to the comparative depth from which it has been projected. He thinks it is "probable that the greater part of the plutonic rocks now exposed on the surface of the earth have been intruded at the bottom of the ocean. A fused mass underlying a vast continent would produce no other effect than gradual oscillations of level during the heating and refrigeration of the mass; but if the molten area partly underlay land and partly an adjacent profound ocean, from the bottom of which it was separated by a comparatively small thickness of sedimentary strata, these strata would offer but a feeble resistance to the expansive force of the fused mass, and might be broken through, upedged, and contorted: the mobility of the superincumbent ocean allowing of, and its pressure assisting in, the folding of the strata."

"Areas sufficiently strong to withstand the expansive force would press the fused matter towards strata already broken through, and the successive determination of the molten mass towards lines of least resistance might cause the upheaval of mountain chains."

He goes on to say that such "a basin of molten matter would commence to solidify from the surface downwards, and the first thin crust would expand at the moment of consolidation, and then contract gradually as it parted with more heat; but it would permanently occupy more space than it did when fluid. As the consolidation progressed, the upper solid parts would be contracting, whilst other portions below would be expanding as they congealed, and the operation of these two forces could not fail to rend the solid crust, and to fill the fissures so formed with fluid matter from below." As to the objection urged against this theory, that quartz and gold could not exist together in a state of fusion on account of the great heat which would be required to fuse the former—more than sufficient to volatilize any contained metals—he adds, "That this is not only admitted, but that it is precisely on these conditions that the igneous theory of quartz veins is based. It is only by supposing that the gold was diffused through the molten quartz in a gaseous form that we can account for its present position in the lodes; for if simply in a state of fusion, its specific gravity would have prevented its distribution."

This may be accepted as a fair statement of his views; but, as his theory is based on assumptions not borne out by observed facts, it cannot be held as even generally applicable. When he supports his statement by observing that quartz reefs become poorer as the depth from the surface increases, and that quartz in the reefs is not laminated, and that a ribboned structure has not been detected, we may safely argue that his theory is not applicable to reefs which are known to yield better at lower depths than on the surface, and to veins which show laminations as clearly as could be wished.†

* *Mineral Veins: An Enquiry into their Origin, founded on a Study of the Auriferous Quartz Veins of Victoria*; by Thomas Belt. London: John Weale.

† Subsequently, in another part of this work, a figure is given showing the structure of a block of quartz from Latham and Watson's claim at Sandhurst, in which the laminations are distinct enough.

The paper is, however, ingenious, and honestly and fairly written; and is supported by so much good reasoning, and illustrated by so many important facts, as to deserve commendation.

As connected with the theories of this writer, it is not out of place to refer to the opinion of the Government Geologist, who says that "granites are in no sense intrusive or irruptive masses, but only the completely transmuted ends of the silurian rocks, that have either been lowered in early geological times to within the influence of central heat, or by some means have been subjected to other powerful transmuting agencies."

It is not possible to cite many facts in support of Necker's theory of sublimation. Though it is true that the conditions necessary to the operations which he is of opinion have resulted in the filling of mineral veins are present in Victoria, yet his theory is wholly insufficient to account for the varied appearances of gold, silver, copper, and other metals, ores, and minerals, which are found everywhere in our reefs. It is true that many of the larger veins lie in contiguity to unstratified rocks; but it has been shown already that such veins, where they have been traced to the plutonic masses, invariably terminate abruptly, and are as clearly separated from them as in quite another way the modern alluviums are. They do not by insensible gradations run into them, nor are they in any way, except by simple contact, connected with them; and all the evidence goes to show that they were formed long after the up-edged claystones and mudstones, and granites, came to occupy the several positions in which we now find them.

Mr. H. A. Thompson, who is one of the most eminent among the many highly-qualified mining engineers of this country, has devoted much time and thought to this important subject, and the results of his investigations will be received with attention by geologists.

In a paper recently written by him he discusses many questions of high interest. He says:—

"The principal evidence against the theory, that veins are formed on the fissures caused by faults, and that these fissures have either been opened at once, or by successive stages, marking different epochs of disruption, and remained open until the material now filling the fissure was deposited, will be found in the veins themselves, for few cases can be produced where such a mode of formation is possible.

"Mineral veins generally penetrate to a great depth, and that not vertically, but with a greater or less underlie through strata of varying character. Under these conditions it is difficult to see how a fissure a few feet wide, from one to two thousand feet in depth, and extending for several miles, could remain open for the hundreds, or perhaps thousands of years that would be required to fill it by the slow process of deposition from water circulating in the fissure, and holding in solution the minerals now constituting the vein.

"Even in hard rocks, and with only a small area open at one time, the greatest difficulty the miner has to contend with is the keeping of the fissure from closing, by means of timber or stone-work, until the contents of the vein can be taken out; and all who have had practical experience in working mines will be aware that it is absolutely impossible for the above theory to be correct.

"The pressure on the sides of the vein increases rapidly with the depth; and in many of the softer silurian rocks, where the smallest fissure would not remain open, we have large mineral veins. Take, for instance, the Old Man vein at Clunes, which is some five or six feet wide at the surface, but in going down swells out to 120 feet

wide, and then contracts again, or rather breaks up, at a greater depth. Many cases of a similar kind are found in the quartz mines of Sandhurst, Maldon, and other parts of the colony, where the veins occasionally open out and form large bunches of quartz. Yet we are asked to believe that such huge cavities have remained open during the long period of time required to fill them.

"Still greater is the difficulty of accounting, on this theory, for the formation of the mineral veins in the diorite dykes found in the schistose rocks. Take, for example, the Morning Star Hill, at Wood's Point, of which Fig. 37 is a cross section.

"The dyke underlies to the west, and is traversed by a series of auriferous quartz veins more or less horizontal, situate one below the other, and having no connection with each other. Portions of the dyke are frequently enclosed within the vein, similar in character to the riders in vertical veins. These parallel flat veins could not have been a series of open fissures, unless the portions of the dyke between them had been suspended by the pressure of the schist on each side—a manifestly absurd supposition.

"The open fissure theory might have been tenable as regards some veins, so long as it was held that the contents of these veins had been of igneous origin, for the minerals forced into the fissure in a molten state might have kept it open, as in the case of trap dykes; but when the igneous theory has been abandoned, it is inconceivable how geologists can cling to a supposition so opposed to all experience. It may be urged that when the veins were formed the rocks might have been in such a hard and compact state as to allow these fissures to remain open. There is no evidence, however, to support such an assumption, and all analogy would lead to the contrary belief. But even supposing that the rocks had at some time been so hard as to allow of open fissures, penetrating to a great depth, this theory will not account for the formation of the small detached leads and bunches of quartz found scattered throughout the silurian rocks wherever these rocks have been much decomposed, nor for the shallow gash or wedge-shaped veins which do not penetrate far from the surface. In these cases there could be no circulation of currents of water, for the quartz leads only extend a few feet, and the gash veins are closed before they reach the deep source from whence the contents of the veins are, it is assumed, derived.

"The conditions under which riders (*i.e.* detached masses of the bounding rocks enclosed in the vein) occur in veins are also incompatible with the open fissure theory. Fig. 38 is a section of a Lead vein in the limestone rock, where the dark lines represent the ore in the vein, and in the strings or joints, *e e e*, connected with it. It will be seen that the rider *a* appears to have been separated from the wall of the vein by the gradual filling and expansion of a joint at *b*. At *c d* is shown a similar joint filled with ore, where, if the deposition of minerals continued, the vein would form along the joint *c d*, and the enclosed block would be converted into a rider. Sometimes these riders remain *in situ*, in other cases they have been lowered for some distances, probably through the decomposition and removal of the constituents of the vein on which

FIG. 37.

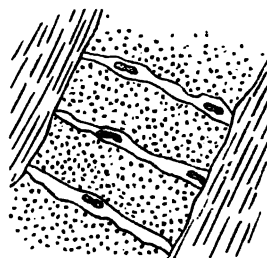
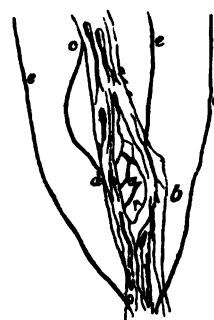


FIG. 38.



VERTICAL SECTION.

they had rested. The riders in flat veins present much the same appearance as those in the vertical veins, and have evidently originated in the same way.

"To recapitulate. We have opposed to the theory that mineral veins have been open fissures caused by some disruptive force, either acting at once or by a succession of movements, and filled by the gradual deposit of minerals brought from below in currents of water circulating in the open fissures—

"1st. The impossibility of any fissure remaining open, even to the smallest extent, in most of the rocks traversed by vertical or horizontal veins.

"2nd. The fact that this theory will not account for the filling of the wedge-shaped veins, nor for the formation of the surface bunches and the detached leads or strings of quartz.

"3rd. The phenomena attending the occurrence of riders both in flat and vertical veins. * * * * *

"Nearly all the facts observed point to the gradual formation of the veins by the same law of replacement atom by atom, which causes a tendency in the constituents of some rocks to aggregate in bands or round some centre—a law still obscure, but the existence of which is now generally acknowledged. The forming of the vein fissures and the deposit of minerals in them appear to have been simultaneous operations.

"It will also be found that the majority of mineral veins are not formed on faults, but either on the cleavage or divisional planes.

"All rocks, however elevated they may be above the water level of the country, are more or less porous, and hold a large percentage of water. * * *

"Many very productive veins are met with which only penetrate a short distance from the surface of the earth.

"Flat veins are formed between the layers of limestone beds, and are frequently very rich. The galena deposit of Wisconsin, in the United States, is of this character; and in many places is so regular as to allow of its being worked in the same manner as a coal seam.

"The flat veins of quartz in the diorite dykes do not penetrate to any depth, and are really detached strings of quartz having no connection with each other.

"Detached masses of metallic ores are found in the cavities formed in hard crystalline rocks, when these cavities are not connected with any joint.

"Bands of granite are found impregnated with metallic ores, and these ores are also found disseminated in sedimentary strata.

"Recent deposits of ore have been formed in old workings, where they could only have been derived from the rocks bounding the vein.

"It will be seen how impossible it is in some of these cases—how improbable it is in others—for the minerals to have been derived from some source deep in the earth, and to have been brought to the surface and deposited in open fissures, either by currents of water or by sublimation.

"On the other hand, how readily all the observed facts may be accounted for by adopting the theory which derives the mineral contents of the veins from the rocks bounding them, and assumes these contents to have been deposited on the joints or fractures of the rock, which have been enlarged by the aggregation of the minerals in them, operating by the law of replacement whose action is so marked, and perhaps in some instances assisted by the magnetic tension. If a steel plate can be removed atom by atom, and each atom be replaced by a corresponding atom of silver—a fact established by direct experiment—it will be readily seen that a mineral vein may be formed in the same way.

"Further evidence in support of this theory will be discovered in the fact that productive veins are rarely found in hard crystalline rocks, unless a portion of these rocks has undergone decomposition. Bischoff has noted this, and points out that 'the removal of the constituents of a rock is always preceded by its decomposition, and is facilitated by the advance of the decomposition. Wherever quartz exists in lodes, the adjoining rock is more or less converted into kaolin, so that we find in one place what is deficient in the other; and when it is found that the abundance of ore in a lode is proportionate to the extent of the decomposition of the adjoining rock, this circumstance can only be regarded as a consequence of that decomposition.'

"This peculiarity may be noted even in the lower silurians of the western gold-fields of this colony, greatly changed as these all are; but it is most marked where these rocks are hard and crystalline, as in some of our mountain ranges, or in the upper silurians; for in the latter the cleavage (which is one indication of this decomposition) is imperfect, and only extends over limited areas, and in consequence the veins formed in them have a corresponding character. When this decomposition has not penetrated far from the surface the veins will soon die out, or become worthless; but when the decomposition sets down to a great depth, the veins will do so likewise, and are as likely to bear ore below as at the surface. Auriferous veins are only an apparent exception to this rule, for although the rock may be rich in gold, yet the latter may be prevented from collecting in the veins, because a considerable portion of it has already been aggregated in the rock, and requires a second decomposition to liberate it. Cases may therefore occur where there has been a sufficient metamorphosis of the schists to allow of large quartz veins being formed at great depths from the surface, while the bulk of the gold may still be retained in the bounding beds.

"This apparent incongruity may be easily explained: In assisting the decomposition of the rocks and the aggregation of its constituents in the veins, water no doubt acts an important part, and with the exception of gold, the veins are found to be as productive in metals at some distance below the water-line as they are above that point. But this is not always the case with auriferous quartz veins. Gold is generally found intimately associated with the sulphides of iron, being aggregated along with them, and in auriferous strata the iron ore, whether collected in the quartz veins or scattered in detached crystals through the rock, is seldom found without gold. This intimate association also exists in the case of the recent pyrites formed in the auriferous drifts, which invariably contain metallic gold incorporated with the sulphide of iron. The same affinity may be illustrated by placing a piece of quartz containing iron pyrites in a weak solution of chloride of gold, and adding any organic substance, when a deposition of gold occurs on the pyrites, but none on the quartz. In many places the total amount of this ore in the schists is very great, and we can understand what a large quantity of gold may be locked up with it. Still in localities where the sulphides of iron are not plentiful, or where the decomposition of the rock has been so great as to allow a considerable proportion of these auriferous sulphides to be removed and aggregated with the quartz, rich gold-bearing veins will be found below the water-line, irrespective of the depth.

"When the sulphides in the rocks are completely decomposed, as they are found above the water-line and near the surface, the gold thus liberated is then in a condition to be acted on by other agents, and it is probable that nearly the whole of it has been accumulated in the veins, forming the rich surface deposits so frequently met with. The rich casing or layer of auriferous slate running by the side of the quartz, which

is occasionally found above the water-line, changes below that point into a layer of slate full of auriferous pyrites, and an extension of this action to the bounding rocks will account for the surface deposits.

"A similar illustration is afforded by the diorite dykes of the Wood's Point District. Near the surface these dykes are much decomposed, and in this condition the quartz veins traversing them have yielded large quantities of gold; but as the rock becomes hard and compact at a greater depth, the gold in the veins decreases, indicating that this decomposition of the bounding rock, and consequent liberation of the contained gold, was necessary to the aggregation of the latter in the quartz veins. The dyke may contain quite as large an amount of gold where the quartz veins are worthless as it does where they are rich, but it will require long ages to pass over before the necessary changes are effected that would render this gold available."

These extracts from Mr. Thompson's paper are valuable, because he is qualified, both by scientific teaching and mining experience, to speak with some authority on these questions. Yet it would seem that his theories are not applicable to all veins; nor, as I read his paper, are they intended to be.

Mr. Thompson, having had abundant opportunities of examining many veins in the several districts of the colony, has furnished at my request, and expressly for this work, additional notes and diagrams. If his opinions clash with any others here enunciated it is not a subject for regret; because my object is to get at the truth, if possible, and not to support any theory which commends itself to my mind. But, in placing the views of others thus prominently, I do not therefore surrender my own convictions.

Mr. Thompson's notes are as follows:—

"The veins in the lower silurians have generally formed on the cleavage planes, and where the metamorphosis of the schists which these planes indicate penetrates to a great depth, the veins will do the same, and will generally continue to yield paying gold. Where these schists have a hard, compact, crystalline structure, the veins will not form in them, except in thin leads, and these seldom carry paying gold, except at the surface. A marked example of this peculiarity is seen in some of the Gippaland ranges. Besides these regular veins there are others of exceptional character, which will be noticed below.

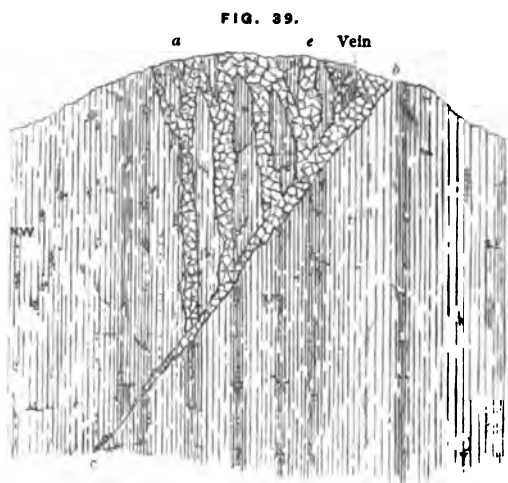
"In the upper silurians, the veins generally form on the divisional planes, and from the decreased metamorphosis of the rocks, as compared with the lower silurians, are more apt to form rich surface patches of quartz, which do not penetrate to any depth. Where the veins do bear to a considerable depth, it will be found that the change in the rock has done the same; and as this change is generally local, not extending over any large area, the veins bearing to a great depth are comparatively few and far apart. The upper silurians are, however, frequently traversed by diorite dykes, whose origin has not yet been settled. At one time they were considered dykes of intrusion, but the examples of gradual change from schist rock to diorite, which may be seen in the Wood's Point District, throw considerable doubt on this origin; and I am inclined to think that further investigation may show these dykes to be metamorphosed bands of schist rock.

"The veins formed in these dykes are usually flat, with a dip in the longitudinal direction of the dyke where the dyke is wide; but in the narrow dykes the veins are usually very irregular, being short detached leads of quartz. Generally the veins only bear well where the dyke has been decomposed and is comparatively soft; but in one instance—the A 1 claim at Raspberry Creek—the rock bounding the quartz is

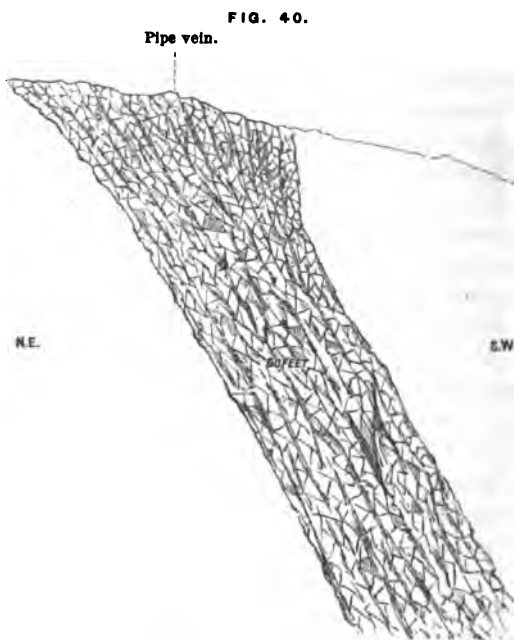
exceedingly hard, although close to the surface. In this case the character of the dyke is due to its infiltration with silicious matter, which has converted it into a quartzite; and the powerful aggregative action indicated by this change has no doubt been the cause of the increased richness of the quartz leads traversing this quartzite, for they become comparatively poor where the dyke assumes its ordinary character.

"As an example of a vein forming on the divisional planes, we may take the Royal Standard Mine, in the Wood's Point District, of which Fig. 39 is a section across the vein. This vein, running along the crest of a low range, at one point throws out leads into the overhanging wall as it approaches the surface; and on the crest of the range, the whole width from *a* to *b* has yielded large quantities of gold. In this case the vein *b c* has probably been first formed on a divisional plane or joint, and the disturbance thus caused has formed fissures in the hanging wall near the surface, which has facilitated, or at least guided, the aggregation of the branches *a c*. I have seen a similar formation at Steiglitz, where the main vein was vertical, and the inclined veins passed through a sandstone to the surface. The celebrated Comstock Lode has the same character, but on a gigantic scale, the distance across the leads being several hundred feet.

"The All Nations Vein, at Matlock, presents something like what is called a pipe vein. It can be traced for a long distance, but is not continuous, being a series of uncertain leads of quartz. At the All Nations Claim it forms a pipe some sixty to seventy feet long, and twenty-five to thirty feet wide, of mixed slate and quartz, dipping at an angle of some 50° from the vertical line (Fig. 40). This pipe spreads out a little at the surface, where the mixed slate, clay, and quartz were very rich. At 150 feet down, the pipe still retained the same size, but the yield of gold had fallen to a few pennyweights per ton, and I do not expect that it will penetrate to



CROSS SECTION.



LONGITUDINAL SECTION.

any great depth ; indeed the pipe will most likely break up at no great distance from the surface.

"Another singular pipe vein is the Achilles Reef, at Taradale. Where this vein crops out at the surface, it is from twenty to thirty-five feet wide, and forty feet deep, and it is traced for 232 feet from the surface, with little change in its size.

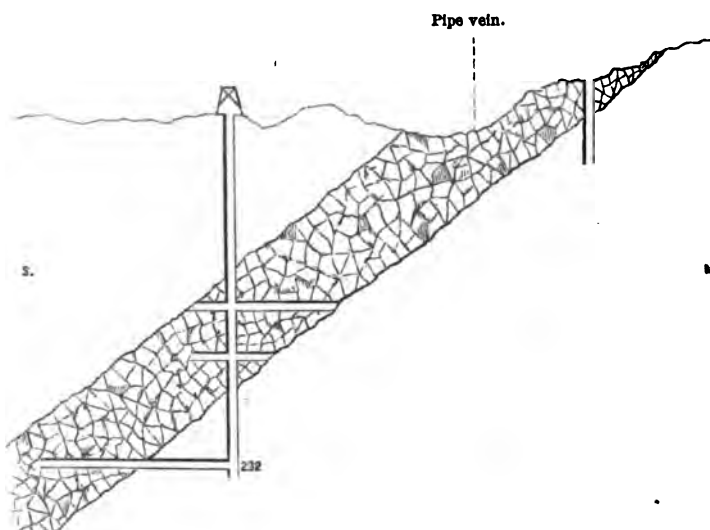
The pipe appears to be attached to a thin vertical lead of quartz, in which gold has been seen. Figs. 41 and 42 are longitudinal and cross sections on this vein, from which it will be seen that although the rock has been sunk through for a considerable distance below the pipe, no other formation of the same kind has been met with.

At the surface

this vein was exceedingly rich throughout its whole width, but the gold gradually fell off as they got deeper, until at length only a few feet on each side of the pipe was worked, the quartz in the middle being too poor to pay for extraction. The richest quartz was found on the foot-wall of the pipe. To the east of the vein is a hard crystalline slate ; to the west a soft slate with well-marked cleavage planes. No sign of another pipe coming to the surface can be traced either to the north or south of the outcrop. The string to which the pipe is attached is little more than a mineral joint, with leads of quartz putting in at intervals, and following the direction and dip of the cleavage.

"Another peculiarity in the mineral veins of this colony, is their frequent tendency to dip in the direction of their bearing. Instances of this peculiarity may be found on every goldfield. One of the most marked cases is the Mariner's Reef, at Maryborough. This reef crops out at the surface of a low range, and within 1,000 feet of horizontal distance it dips vertically some 650 feet. From an examination of the heaps of waste at the mouth of each shaft, I was not able to detect any change of rock that would account for this dip of the vein. The country was all of similar formation—

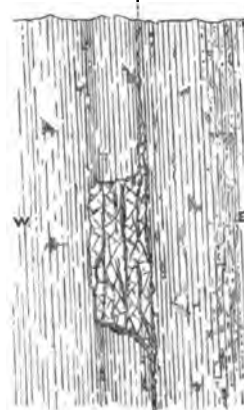
FIG. 41.



LONGITUDINAL SECTION.

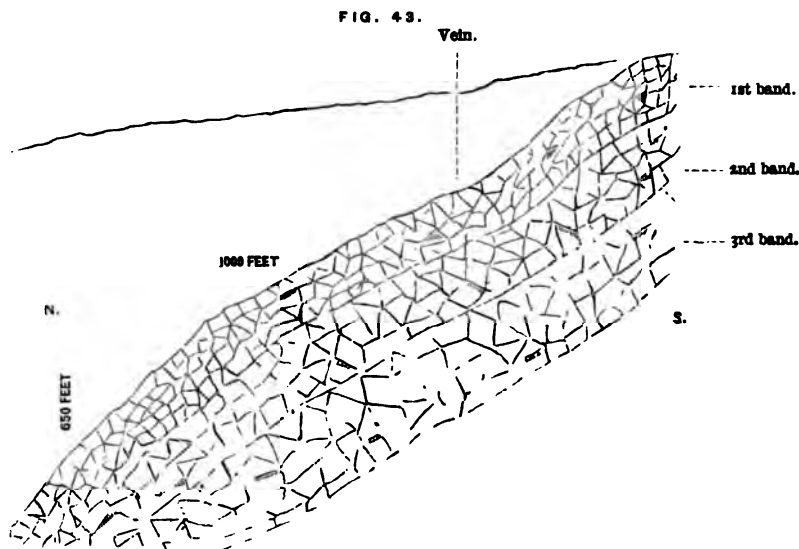
FIG. 42.

Pipe vein.



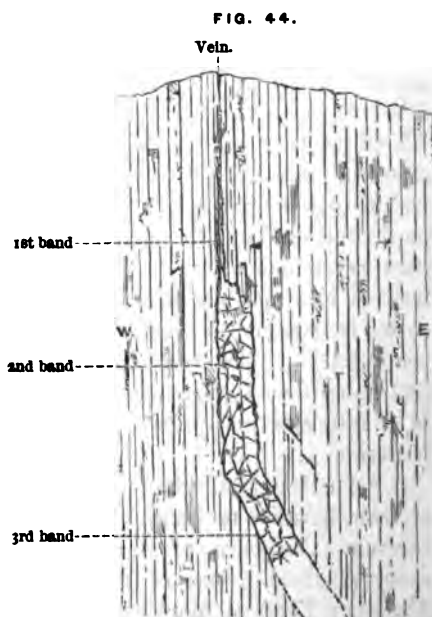
CROSS SECTION.

slates with well-marked cleavage planes. The dip was to the north, as shown in Fig. 43, and it appeared to increase at the deeper levels. The cross section, Fig. 44,



LONGITUDINAL SECTION.

is of singular character. The first band consists of a thin lead of quartz, from four feet to twelve feet wide, very rich at the surface, giving from 20 to 60 ozs. of gold per ton, but the yield decreasing in depth. Where sunk through it is some fifty feet deep. The second band is some eighty feet deep, and four to ten feet wide, of poor quartz. The third band has only been sunk on some forty feet, and only differs from the second band in its striking across the cleavage, and the change this causes in the character of the quartz. The amount of gold increased, and this was accompanied by pyrites and galena, indicating an increased tendency to aggregate the minerals in the vein, a result which usually follows a change in the direction of a vein from that of the cleavage planes* to a joint striking across them. How far this change in the underlie of the vein will continue, or whether this vein may not prove to be only a pipe, are questions yet to be settled; but from



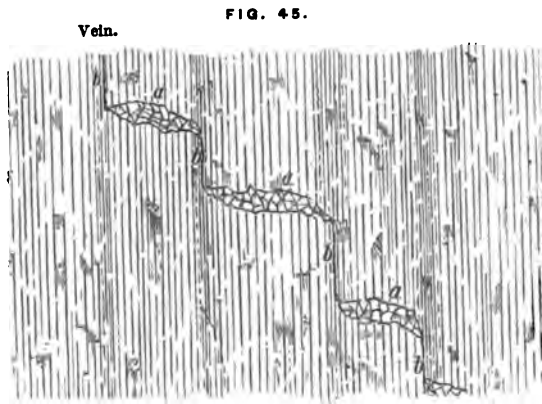
CROSS SECTION.

* I believe that what are termed cleavage planes by Mr. Thompson are usually regarded as planes of bedding. The silurian rocks of this country in most places are unaltered mudstones and sandstones, jointed, but showing clearly the surface-junction of the strata. I regret I am unable to submit the matter to Mr. Thompson for further elucidation.

the surface of the small vein about 170 feet has been proved on the northern dip. Of the vein to the south I did not obtain any reliable information.

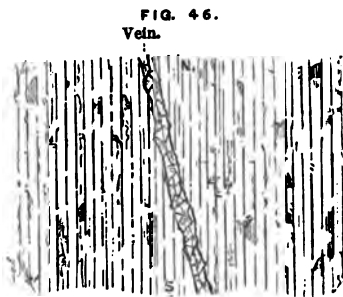
"Of the veins crossing the cleavage in direction or underlie, or both, there are many examples, and this class has usually made rich mines.

"One of the first opened was Lewis's claim at Whroo, which I examined in 1855, and Fig. 45 is a plan or horizontal section as it then appeared. The vein followed the vertical planes of the rock for a short distance, and then struck across the joints, opening out in these places, where the quartz was usually very rich (*a a a*, Fig. 45), so as to have a zig-zag course. Whether this singular character was retained to any great depth, or it assumed a straight course, I am not aware; but I saw a thin vein, of precisely the same kind, at the Caledonian Diggings, poor where it ran with the joints, rich where it crossed them.



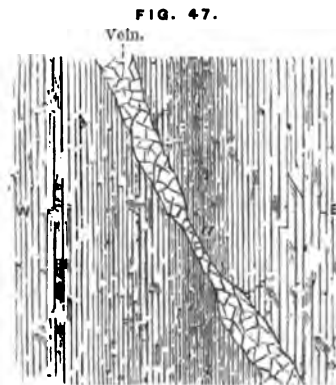
PLAN, OR HORIZONTAL SECTION.

"Another vein of this description was Davis's at Steiglitz. This was from six feet to eighteen feet wide, and exceedingly rich when first opened. A plan or horizontal section is shown in Fig. 46, and a vertical section in Fig. 47. About thirty feet from the surface, the vein crosses in the dip a hard band of crystalline schist, which pinches it, and the quartz in this pinch is hard, bluish, and semi-crystalline, with hardly a trace of gold in it (*a*, Fig. 47). Below this band the vein again recovers its character, and I believe, since I saw it (in 1856), has been followed to a depth of 200 to 300 feet. I believe the rich yield of this vein, as compared with others traversing the same rocks, to be entirely due to its position as regards the cleavage.



PLAN, OR HORIZONTAL SECTION.

"Some of the veins at Chinaman's Flat, near Maryborough, are also of singular character. Their bearing is the same as that of the cleavage—nearly north and south; but the cleavage dips to the east, while the veins strike down vertically across the cleavage, and have a tendency to throw off leads up the cleavage planes on the western side, or to follow cross joints on that side, the whole vein thus making jumps to the west, and in one instance forming a large flat vein on that side. The vein is a mass of mixed slate and quartz (what is called by miners a 'rubbly reef'), and the gold is found both in the quartz and in the enclosed



VERTICAL SECTION.

masses of slate, in the latter case appearing as fine gilding on the cleavage faces. The adjoining rock is much changed, in many cases converted into a state of semi-pipeclay. Several of these veins run parallel to each other, and their denudation has no doubt produced the alluvial gold of the flat. They have not yet been traced to any distance below the water-line, and it will be a matter of great interest to note the changes that will take place in the character and bearing of these veins as the rock becomes harder in depth. The walls of the veins are very irregular and broken, as shown in section, Fig. 48.

"The deposit of gold in slate is not uncommon. In one instance, at Clunes, the quartz disappeared from the vein for a short distance, and the space between the walls was filled with rich auriferous slate, the gold being deposited in a minute state of division, like fine gilding on the faces of the cleavage planes.

"At Sandhurst the veins form what are locally called saddles, and these have been usually considered as marking the line of an anticlinal axis. This may be the case on some of the lines of mineral deposit, but it does not appear to be so in the only case I have had an opportunity of examining minutely, that of the Newchum Reef.

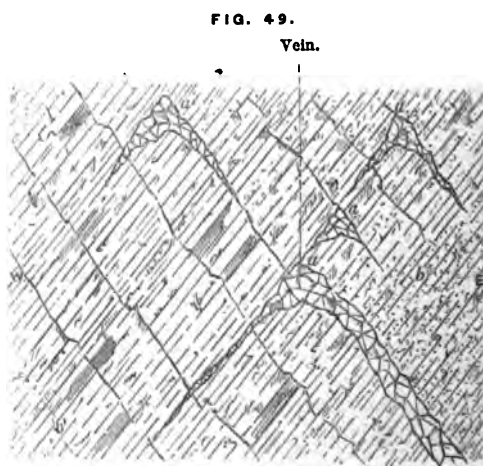
"In that case the dip of the strata, or rather cleavage bands, is to the west, at an angle of about 20° from the vertical line,—and this is crossed by joints dipping east,—which may be either divisional or bedding planes. The vein appears to have a tendency to form on both these planes, there being usually a mass of richer quartz at the apex (*a a* Fig. 49.) The legs or spurs striking down the planes, seldom penetrate to any great depth, unless some change in the rock renders them more permanent.

"In this case a hard crystalline rock (*b* Fig. 49) puts in in depth and the vein forms against its western face, dipping with it to the east.

"The quartz-mining district of Sandhurst is a very interesting one, and would



CROSS SECTION.



CROSS SECTION.

well repay a careful investigation into the character of its different lines of quartz veins and the deposit of gold in them.

"The question of the age of mineral deposits is one of some importance, even in a practical point of view. All interested in these matters must have noticed that veins frequently crop out on the crests of the hills; but this has usually been ascribed to the harder nature of the quartz veins rendering denudation more difficult. We have hardly had a sufficient number of facts collected and classified to enable a fair judgment to be formed on this point. But the generally increased richness of auriferous veins at the surface, and the great number of rich surface deposits where the veins are worthless, together with the absence of rich deposits in depth where the surface quartz has been worthless, and the tendency of these rich deposits of surface quartz and slate to form on the crests of low hills, or as the veins are crossing ridges, certainly lead to the inference that the form of the surface has some effect on the deposition or aggregation of the gold, more than is due to the decomposition of the sulphides in the rock. If the present form of the surface has had this effect, it would follow that the aggregation of the gold is of later date than the time when the surface assumed its present general outline. This is a matter which requires further investigation.

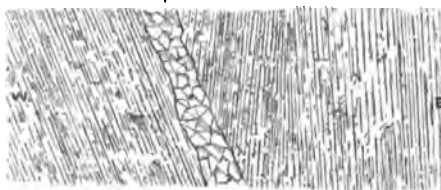
"I have lately had an opportunity of examining other lines of mineral veins at Bendigo, where I find that—as in the case of the Newchum Vein—they have not formed on an anticlinal axis.

"On the Hustler's Reef Line, the dip of the cleavage is to the east, and in two places where the dip—after passing through a vein—was changed, this alteration was only a temporary one, and the old dip was soon established again, as shown in section, Fig. 50.

"The veins forming the Victoria Line, traverse beds dipping to the east, although the underlie of the veins is not the same. The section, Fig. 51, is sketched from a portion of this line, the dotted blocks indicating what are called sandstones, but these change into hard crystalline schists in depth.

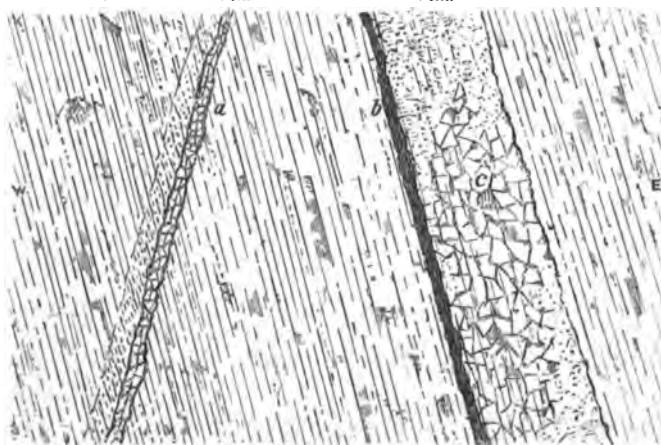
"The vein *a* is underlying to the west; on the west wall is a hard compact rock, and beyond this the ordinary slates dipping west. On the east side the cleavage runs up to the vein. This appears to be a favorable position for collecting gold in the vein, and the latter has in this instance been very productive.

FIG. 50
Vein.



CROSS SECTION.

FIG. 51.
Vein. Vein.



CROSS SECTION.

"The vein *b* is underlying with the cleavage, but to the east is a band of sandstone in which another vein *c* has formed. This sandstone is traversed by irregular joints on which the quartz has formed, and the vein is nearly vertical; beyond this sandstone band is slate rock still dipping to the east.

"On the same mineral band there is an interesting example of the manner in which gold is aggregated on particular lines, and has been cut off, or rather prevented from extending by a mere joint at the junction of what appear to be two distinct bands of quartz, probably formed at different times.

"Fig. 52 is a longitudinal section along the line of the vein. The joint has been traced to nearly 500 feet in depth, carrying a seam of black carbonaceous clay, and at uncertain intervals the quartz forms on this joint in irregular

FIG. 52.

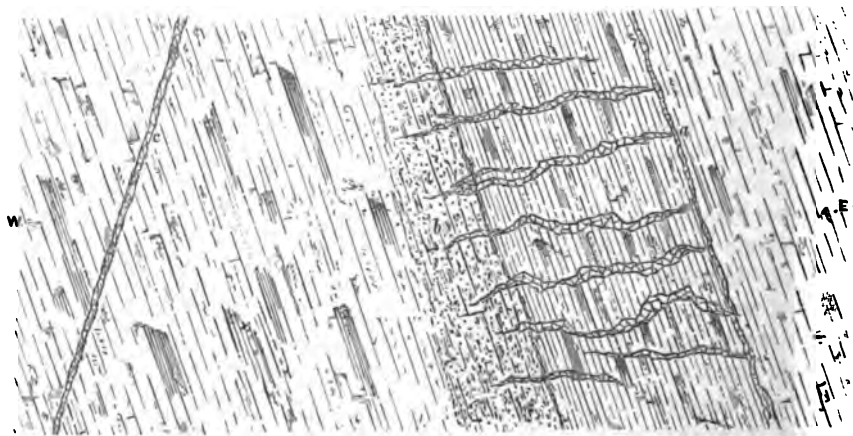


LONGITUDINAL SECTION.

bands, dipping t^0 the north. The section represents the junction of two of these bands, the portion of the joint having quartz formed on it being indicated by shaded lines. The bands at *a a* are poor, but the portion cross-shaded at *b* was exceedingly rich up to the point *c*, where it joined the southern band, when the gold at once ceased.

"There is another singular formation on the same line of veins, some two miles further to the north, shown in section, Fig. 53. A joint carrying a seam of carbonaceous clay (*a*) strikes down with the cleavage; at a distance varying from

FIG. 53.



thirty to forty feet west of this joint is a band of hard sandstone (locally called granite), in some places so impregnated with silica as to be almost converted into a

quartzite (b). The space between is filled in with dark slate having strongly marked cleavage, and the quartz veins or leads strike across this cleavage as shown in sketch, frequently penetrating the sandstone for a short distance, but none of them passing into the eastern wall. These veins form a band of nearly 200 feet in depth, which crops out at the surface and gradually dips to the north. The quartz leads in the upper part of the band have been exceedingly rich, some of them yielding over 20 ozs. of gold per ton, but the yield gradually decreased in depth, and at the lowest point reached, the soft slate appears to be gradually changing into hard compact schist, thin bands of crystalline schist being mixed with the slate.

"To the west is another mineral joint underlying in a westerly direction, as shown at (c).

"Throughout these sections it will be seen that the dip of the cleavage is to the east, the veins dipping in a contrary direction being formed on joints. There may be alterations in the strike of the rock caused by an anticlinal axis, but so far as I have examined, they have no connection with the formation of the mineral veins having contrary underlies so characteristic of the Bendigo Goldfield."

Since Mr. Thompson prepared these notes for this paper, he has had an opportunity of examining some of the mineral districts in the north-eastern parts of Australia, and he informs me that he has found a vein of quartz in granite, from six to twelve inches in thickness, running north-west and underlying rapidly south-west. The vein is cut off by a diorite dyke running east and west (wholly in the granite), and from four to six feet in width (similar to the Raspberry dyke in appearance), and traversed by veins of quartz with gold. Mr. Thompson very properly deems this discovery of high importance, not less perhaps to the miner than to the geologist and mineralogist.

It is right to give attention to the opinions of every practical miner or geologist, who has had opportunities of acquiring information respecting the character and position of our mineral veins; and the following extracts from a Parliamentary paper (not likely to be within reach of the greater number of miners) are so valuable as to require a place here. The author, Mr. R. Daintree, lately one of the Field Geologists in this colony, and now one of the Government Geologists in Queensland, is a gentleman of great ability, and well able by scientific training to give useful opinions on questions of geology and mineralogy. On the subject of mineral veins he thus writes:—

"No subject has, perhaps, been more discussed than the formation of mineral veins. Laying claim to no original ideas on the subject, I shall simply bring forward the published statements, which most coincide with the results I have arrived at by independent observation.

"I had long ago come to the conclusion that most, if not all, the gold in the quartz reefs was derived from the rocks in which these reefs occur.

"That the strata themselves received their supply of gold at the period of their deposition from the ocean in which they were deposited.

"That organic matter, and the gases generated therefrom on decomposition, sulphureted hydrogen, &c., was the cause of the precipitation; and that the amount of metallic deposit was in proportion to the amount of organic matter deposited with the oceanic sediment.

"That subsequent plication and desiccation of the sediment caused fissures, into which the mineral waters percolating the boundary rocks flowed and were decomposed, and their mineral contents were precipitated, possibly by magnetic currents, thus causing mineral veins. * * * * *

"Let us turn to the other question of contemporaneity of reefs, and their associated gold. Let us first consider if solution and precipitation of gold is still going on. We can then better form conclusions on this subject.

"In testing a solid mass of iron pyrites, given me by the Director of the Geological Survey, gold was found throughout.

"This mass retained the structure of a tree stem, and was a replacement of the organic structure by pyrites, and had been taken from the Ballarat drift.

"The same experiment on another tree stem, taken from the same drift, has been repeated by Mr. Newbery, the Geological Survey Analyst, with a like result.

"Unless this gold was carried in a soluble form into the pores of the wood, and there precipitated with the pyrites, it would be difficult to account for its presence.

"Mr. Foord, the well-known chemist and metallurgist of Melbourne, has repeatedly informed me that in operating on the St. Arnaud silver ores with hyposulphite of soda, and precipitating the dissolved metals from the solution, he has usually found that an appreciable amount of gold had been dissolved with the silver, indicating that in that mine, at least, gold may exist as an ore.

"Whether this fact points to the real solvent of the gold and silver precipitates, from their first storehouses in the sediments to their accumulation and reprecipitation as metal in the reefs, is worthy of consideration; certain it is that where found in the sediments themselves, the noble metals are usually associated with sulphur compounds, iron pyrites, &c., and there is no reason why hyposulphites of the alkalies should not be formed in the mineral waters percolating these strata. At the same time, it is possible the St. Arnaud case may indicate more the possibility of gold as a chloride combined with chlorobromide of silver.

"In whatever direction we look for the cause of the original precipitation, and re-solution for after-deposit in mineral veins, we must never lose sight of the fact, that the first agent must have been potent to precipitate both gold and silver, and the second to redissolve the united precipitates, as no gold has yet been found in nature unalloyed with silver.

"That sulphur compounds have played an important part in the reactions which we have endeavoured to explain is evidenced by the fact, that scarcely ever have pyrites taken from the Silurian slates of Sandhurst, Maryborough, and other localities, failed to yield gold."*

The phenomena observed in veins of quite another character are not without interest, inasmuch as they teach that, however diverse the material, the forces which operate are nearly always the same.

Professor Erman, treating of the structural divisions of ice observed on Lake Baikal, in Siberia, thus describes one of the fissures:—"It ran from where we were stopping to the north-east and south-west, with little deviation to the horizon. It had throughout a uniform width of four inches, and was filled with new ice, which gave it the look of a vein or dyke in rock. What added to this resemblance was that the ice filling the crack was always much whiter than the surrounding ice; it was, in fact, traversed by fine cracks or flaws, in a very regular and remarkable manner."

* It is just to the Director of the Geological Survey to observe that he does not endorse all the statements in this report; but he entertains, in common with all who know him, a high opinion of Mr. Daintree's professional qualifications.

A vein in ice—extending a considerable distance horizontally, and penetrating to some depth vertically—might remain open for a period sufficiently long to allow of its being filled with new ice, which would form first on the faces of the walls, and gradually increase until the space between the walls was filled; and in a manner not dissimilar some of the narrow quartz veins in our granitic rocks have probably been formed.

As connected with Mr. Erman's statement, it is interesting to record the formation of a vein of sulphate of lime in the great swamp west of Melbourne. The surface of the swamp is composed of earth, mud, and sandy clay (derived chiefly from the decomposition of basalt), resting on a stratum of marine shells, which again is underlaid by mud and clays resembling kaolin. When the railway works were in progress the workmen made a clean cut off the surface over a considerable area, the stuff being required for the formation of an embankment; and in course of time this area was subjected alternately to moisture and to great heat. When I visited it, and while the works were in progress, I observed a narrow crack in the smooth surface of the mud which was traceable for a considerable distance. It was not more than one or two inches in width, and its depth was not probably more than a few feet. On the sides of the slightly hardened mud, which formed the walls of the vein, I saw small crystals of sulphate of lime; and, in some places, the vein was quite filled with what might fairly be called selenite. All the conditions necessary for the formation of gypsum, and for its solution and deposition, were present there; and I was able to watch the process of filling the vein for a considerable time. On the sides of the vein there appeared, first, small right rhomboidal prisms with bevelled sides; subsequently, larger arrow-head crystals; and finally, where the vein was wide and the action had been continued for a longer period, compact gypsum. This, when taken out of the vein, bore on each side exact impressions of the bounding walls, though these, as I have said, were but soft mud or clay.*

Waters charged with bi-carbonate of lime leave, in this warm climate, incrustations of carbonate of lime wherever they come to the surface. At Cape Schanck the basalt has a thin capping of calcareous sandstone; and the surface waters, percolating through this, have filled the cavities and joints of the underlying rock with carbonate of lime, and have caused to form numerous stalactites and stalagmites in the caverns. In some places, notably near the hill projecting towards the Pulpit Rock, this is observable. Here the basalt has been decomposed and carried away; and there are

* An interesting paper, published in the *Quarterly Journal of the Geological Society* (February 1st, 1866) and entitled, "On some spaces, formerly occupied by Selenite, in the Lower Eocene Clays of the London Basin; with remarks on the origin and disappearance of the mineral," by P. Martin Duncan, M.B., Lond., Sec. G.S., has come into my hands since the above statement was written.

Mr. Duncan gives much useful information relative to the origin of selenite, and he properly insists on the distinction between this mineral and gypsum.

Large plates of selenite are found in the sandy clays of the north-western parts of the colony; and the late Dr. Becker made a collection of tertiary fossil shells which were composed wholly of almost transparent selenite. That its origin was as described by Mr. Duncan is almost beyond doubt. Not alone as touching this subject, but as connected with geological investigations generally, Mr. Duncan's paper is full of suggestions.

When searching for fossils lately, in the palaeozoic rocks near Melbourne, I found thin plates of gypsum in the planes of bedding, and in the joints of rather hard, dark claystones where they were exposed near a creek. The upper beds (white and pale-red sandstones) were full of obscure impressions of fossils, and contained throughout small quantities of carbonate of lime.

standing over the whole of the denuded surface upright plates of carbonate of lime, and thin sheets of the same mineral very curiously arranged, representing joints and cracks of a rock which has disappeared.

Quartz rock (not quartz as found in veins) is often seamed and veined by quartz, due to infiltration.*

Mr. Henry has proved by experiment that a silicate of soda is decomposed even by the carbonic acid of the atmosphere, and the silica deposited; and every fragment of a petrification shows that silica may be thrown down—molecule by molecule—in such a way as to replace the original constituents, and to preserve the form of plants.

The thin layers of white chalcedony, with cavities presenting innumerable very small transparent hexagonal crystals of quartz, which are found in the kaolin at Bulla-Bulla; the ferruginous opal found in the decomposed basalt, near Essendon; the cacholong and hydrophane from the quartz reefs at Pleasant Creek; the pholerite, which occurs in the quartz veins at Sandhurst; the flattened, elongated, abnormal crystals of quartz, found at Fryer's Creek; and the geodes of chalcedony, from the Moroka Valley in Gippsland, are sufficient to show that the manner of the aggregation of silica and of silicates of alumina, affords abundant material for study, and is yet but imperfectly investigated.

"In Spring Creek, Beechworth, a very interesting discovery was made some time ago by Mr. Dunn, in a vein of felspathic clay, traversing granite, and overlain by auriferous drift. The whole of this clay-vein is interspersed with thin glass-like plates, scales, angular chips, and numerous unsymmetric, sharp, angular polyhedrons ('pseudo-crystals') of light-yellow to dark brownish-red chalcedony (carnelian?). A great number of these pseudo-crystals, which are mostly hollow, contain fluid and air-bubbles in the cavity. The size of the bubbles varies from a pin's head to that of a bean, and that of the crystals from a quarter of an inch to three inches cubic. Several specimens have been found containing each two, and some three, fluid cavities with air-bubbles; others, with sharp, knife-like edges all round, yet hardly one-eighth of an inch thick in the centre, show each a large bubble, traversing a cavity occupying nearly two-thirds of the length and breadth of the specimen. In most of the specimens the inner walls of the cavities are coated with small quartz crystals, in the others they are quite smooth; and it is clearly observable that the air-bubbles of these latter travel far slower than those of the former, a circumstance which might point to the probability of the fluid in the smooth cavities being still strongly charged with silicic acid, which in the others has crystallized out. It is a curious fact that the chalcedony of these 'water stones' has a hardness above 8, as the sharp edges scratch topaz easily."†

Knowing that Mr. George Foord had investigated the character of these pseudo-crystals, I applied to him quite recently for information respecting them, and he writes thus:—

"I may explain that although I expressed a positive opinion concerning their nature, the first time I saw them, I have had very little opportunity of a close acquaintance with them. I saw one or two in Mr. Aplin's hands, when I offered reasons against regarding them as crystals, and for regarding them as agates whose external faces were due to the angular spaces in which they had been formed.

* *Geological Observer*, De la Beche, p. 695.

† Mr. George H. F. Ulrich, F.G.S., in the *Physical Geography, Geology, and Mineralogy of Victoria*, p. 71.

Mr. Aplin was good enough to lend me one for an evening; the fluid which it contained was leaking out at what I may perhaps call the infiltration aperture; and I examined a drop or two of this fluid. What I remember amounts to this: The fluid was water, but slightly mineralized; it showed the sodium line in the spectroscope; and left a slight residue when evaporated on glass. One other point I remember: Some of Mr. Aplin's specimens were solid (not hollow), and the final filling up was not with layers of amorphous silica, but with a deposition of quartz crystals interlacing, just as the centres of agate geodes are filled up."

A great number of these water stones, and a mass of the clay enclosing the chips and pseudo-crystals, were exhibited in the Intercolonial Exhibition. Those figured below are of the natural size.

Though most of the silicates which occur naturally "are practically insoluble in water, or in any other fluids which are found abundantly in nature,"* yet, as we know nothing of the chemical combinations into which they might have entered, previously to their deposition, it would be rash to conclude that they may not (under some conditions) have been set free at ordinary temperatures, and in such a manner as to form veins of considerable extent and thickness.

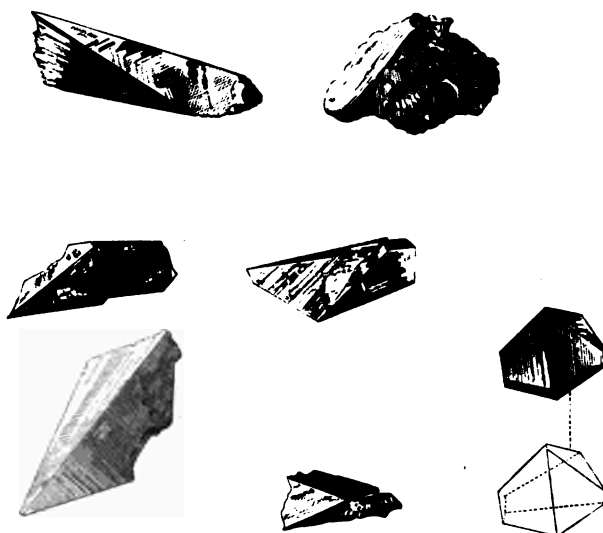
According to Mr. Jeffries (*Reports of British*

Association, vol. x.), "The vapour of water, at a temperature above that necessary to melt iron, dissolves silica, even attacking compact undivided minerals; and a jet of such steam containing dissolved silica deposits a *snow* of quartz crystals, as it cools on escaping from a vessel."†

Quartz crystals have been produced artificially, in the laboratory, by other methods.‡

Specimens of quartz taken from a vein near Maryborough exhibit some features which are deserving of careful attention, as they appear to show that some of our veins have been formed very slowly, and at low temperatures. Fragments of the bounding wall are adhering to and enclosed in the quartz, and if these fragments be carefully removed it is observed that they are composed of a bluish claystone, everywhere containing the casts of cubical pyrites. The counterpart—the quartz—follows exactly the smallest lines and indentations of the wall, and where a crystal of pyrites has protruded from the mass a clear cast of it is exhibited on the face of the quartz.

FIG. 54.



PSEUDO-CRYSTALS, BEECHWORTH.

* Beete Jukes.

† *Ibid.*‡ Mill's *System of Logic*, second edition, vol. I. p. 452

Specimens of quartz from reefs occurring near the River Goulburn exhibit in a remarkable manner nests and cavities which have been once filled with sulphides and other minerals.

Mr. Fox's experiments, which show that metalliferous veins may be formed artificially in the laboratory, and his observations on these phenomena, are perhaps our best guides in conducting investigations.

The whole subject is, however, involved in obscurity; and though it is not possible for any one who has given attention to it to attach equal weight to the several theories which have been proposed, he would do wrong rashly to dismiss any of them as altogether improbable.*

* The following account, drawn up by Mr. Phillips, of a large quartz vein, believed by him to be now in process of formation by hydrothermal agencies, in Steamboat Valley, near Virginia City, is highly interesting and suggestive:—

"The principal gold-producing portion of California extends, on the western slope of the Sierra Nevada, from the Téton Pass to the northern extremity of the State.

"The slates of which it is mostly composed have been shown by the officers of the Geological Survey to belong chiefly to the Jurassic period, although the occurrence of Triassic fossils in the auriferous rocks of certain sections of the belt renders it probable that some of the slates in the heart of the gold region belong to that age.

"These sedimentary rocks for the most part consist of various slates and schists, more or less metamorphosed, and sometimes containing nodules of felspar; sandstones are also frequently met with, and these are often transformed into quartzites. Black talcose schists with slates, exhibiting a well-defined cleavage, together with bands of more or less crystalline limestone, also occur. * * * * *

"The matrix of the auriferous veins of California is invariably quartz, which is usually crystalline, and, in the majority of cases, is ribboned in such a way as to form a succession of layers parallel with the enclosing walls. In some cases these parallel bands are separated from each other by a layer of quartz, differing slightly, either in color or structure, from that forming the seams themselves; whilst in others they can only be distinguished by the difference of color of two adjoining members of the series.

"In many instances, however, laminae of the enclosing slates divide the vein into distinct bands, and in such cases the thickness of the interposed fragments is often not greater than that of writing paper.

"In addition to ordinary quartz, amorphous silica, or semi-opal, and chalcedony are sometimes met with; and this opal, which is interfoliated between the layers of true quartz, occasionally contains iron pyrites and metallic gold. The walls are in most instances smooth, and often afford evidence of a considerable amount of mechanical action, whilst between them and the vein itself a thin stratum of clay or *flucan* is sometimes interposed.

"In some of the detrital deposits of the gold regions distinctly marked quartz veins are observed cutting through the gravels, and are evidently formed by the action of water holding silica in solution. In certain localities also bands of silicious slates are found to contain small quantities of gold. * * * * *

"Boiling and hot springs are exceedingly numerous throughout California, and in the adjoining State of Nevada; and in Steamboat Valley, about seven miles from Virginia City, a large quartz vein appears to be now in process of formation by hydrothermal agencies. The hot springs of this locality are situated at a height of 5,000 feet above the level of the sea, on the eastern declivity of the Sierra, and the granitic rock here presents several straight and parallel fissures, either giving exit to heated water, or simply ejecting steam. The first group of openings comprises five longitudinal crevices, extending in a straight line, and parallel to each other for a distance of over 3,000 feet. These fissures are separated from one another by intervals of from forty to sixty feet, have each a width of about twelve inches, and are connected with each other by lesser openings, intersecting the first nearly at right angles to their direction. All these crevices are usually full of boiling water, which overflows and escapes in the form of a rivulet; at other times it does not flow over, although violent ebullition may be heard to be taking place at a short

The facts observed in connection with the minerals which occur in our reefs would seem most often to point towards an elective chemical force, operating slowly through long periods, rather than to a sudden forcible injection.

If we examine any area of palæozoic country in this colony where the bed-rock is not covered by tertiaries or alluvions, we see parallel veins of quartz running nearly north and south at distances apart, varying from one, and two, to four, six, and eight chains. Some of them are narrow, some are not continuous, and others are very wide, clearly defined, and extend uninterruptedly for five or seven miles. So numerous are they that a map on a small scale is quite scored over with them in such a manner as almost to obliterate the hill features.

Following one of these veins, we find it in one place cropping out on a high range, and at another low down in a valley. Where the deeper tertiaries are penetrated, and the under-surface explored, we find exactly the same system of veins and the same variations in the quantities of gold contained in the quartz. Whether the vein is touched on the summit of a lofty hill, or in the gutter of an alluvial claim, 400 feet beneath the surface, it presents the same features.

The bounding rocks are not, as is generally believed in Europe, crystalline. Most often they are quite soft, unaltered mudstones and sandstones, and in some cases the veins penetrate strata in which, as already stated, casts of palæozoic fossils are clear and perfect. It is necessary to insist on this, and to repeat it, because the belief that our palæozoic rocks are identical in lithological character with those which are described as occurring in the Ural Mountains, has cost us, I may say, thousands of pounds sterling.

distance below the surface. All these fissures have become partially filled by a silicious deposit, which is being constantly increased by the formation of new layers on the sides, whilst a longitudinal central crevice allows of the escape of boiling water and steam. On the most western of these lines of fracture are several centres of active eruption, from which boiling water is sometimes ejected, by the action of steam, to a height of from eight to ten feet. These waters are alkaline, and contain in addition to carbonate of soda, the sulphate of that base, and chloride of sodium. There is also a considerable escape of carbonic acid and sulphureted hydrogen; these products give rise to the deposition, near the surface, of sulphur, and anhydrous oxide of iron.

"To the west of those above described, another fissure having the same origin is observed; but this is no longer traversed by currents of hot water, although at various points throughout its extent it still gives off steam and carbonic acid. At its northern extremity a central fissure remains open, but in other localities it is, for the most part, closed by an accumulation of silicious concretions.

"The total distance over which this deposit can be traced is considerably more than a mile. The deposits of Steamboat Springs are, to a certain extent, metalliferous, and, in addition to oxide of iron, they contain oxide of manganese, together with iron and copper pyrites. M. Laur, a French mining engineer, deputed by the Imperial Government to examine and report on the mineral resources of the Pacific Coast, states that they also contain gold. * * * * *

"The above and other similar facts appear to lead to the conclusion that auriferous quartz veins are the result of aqueous agencies, and that their mineral and metallic constituents have, as well as their silicious matrix, been deposited from solution."—*Gold in California*, by J. Arthur Phillips. *The Quarterly Journal of Science*, No. XIX, July, 1868.

Mr. Phillips' observations are valuable, and serve to explain some of the phenomena which present themselves on our goldfields; but it is hard to believe that quartz veins, some of them more than 100 feet in thickness, of great vertical extent, and traceable for many miles, could be formed by the action of hot springs. It is as unreasonable to exclude any probable cause of their origin as to assume that only one course of action has prevailed throughout. Many and various are the conditions under which veins, fissures, and cracks could be filled with silica and minerals and metals.

In some places thin veins of quartz penetrate granite, and veins of remarkable richness have been discovered lying as flat and nearly parallel bands in dykes of syenitic diorite.

The following extract from a report on the gold workings in these dykes by C. D'Oyly H. Aplin, Esq., at one time Acting Director of the Geological Survey in Victoria, and now Government Geologist in Queensland, will be perused by geologists with interest. The report is dated the 26th January, 1864:—

"On this spur, at Wood's Point, at a short distance above and overlooking the township, is the celebrated 'Morning Star Reef,' from which for months past returns appearing to be almost fabulous in amount have been derived.

"The so-called 'reef,' but to which the term is manifestly inapplicable, includes a series of three, and possibly more, horizontal and approximately-parallel veins of auriferous quartz, traversing a dyke of syenite about 100 yards broad at the surface, and widening downwards. The direction of this dyke is about N. 55° W., the general direction or strike of the sandstones and slates of the district N. 45° W. (magnetic). Their dip, as seen at the eastern wall of the dyke, is about 80° to the west; the general dip of the beds, wherever I could see sections, being at very high angles—from 75° to vertical.

"The rock constituting the dyke is a mixture of hornblende and felspar, with but little quartz, and occasionally mica; it might, perhaps, be more correctly termed a *syenitic diorite*. From the surface downwards, as deep as the workings extend, it is in a decomposed state, and no great difficulty is experienced in sinking or driving in it. A good deal of slabbing, however, is required for both. In the lowest tunnel (Hurley and Co.'s), this rock where first struck, and for about fifty or sixty feet beyond, is found to be very hard, and in an almost unaltered condition; this is the case also with large boulders that are found loose in the soil on the flank of the spur. The soil derived from its decomposition is of a very rich character, and vegetables of all kinds are said to grow luxuriantly in it.

"Crossing this dyke at different levels, some sixty or seventy feet apart, are three horizontal bands or veins of quartz, each of which is at present being worked by different parties, whose claims are all registered as being on the same reef—the Morning Star. This may hereafter give rise to some difficulty in the application of the mining by-laws, should they ever require to be appealed to in case of dispute.

* * * * *

"The quartz veins, though horizontally traversing the dyke, are more or less undulating in their course. They vary in thickness in different parts of the workings from one or two feet to as much as twelve, but in the latter case are split up into a mass of thin ramifying and reticulating veins, enclosing between and amongst them portions of the syenitic mass through which they have penetrated. The whole thickness, however, is sent to the mill to be crushed. They abound in crystals of quartz, many of them very perfect in form and beautifully grouped together. Iron pyrites is also abundant, and in Drysdale and Co.'s claim sulphide of antimony had been met with. In tracing the extension of the veins they are working into the adjacent schist rocks.

"As the quartz veins approach the walls of the dyke, they seem to have a tendency to split up and become attenuated; they can, nevertheless, be seen passing obliquely downwards into the slates, but, except in Drysdale and Co.'s claim, do not appear to have been followed further. In Hurley and Co.'s claim I noticed, however, that the quartz, in a solid mass two feet thick, continued its course horizontally, cutting

directly across the slates, but had only been followed as yet about three or four feet into them. Mr. Hurley informed me that at this spot the character of the quartz was rather improved than otherwise, and in Drysdale and Co.'s claim the quartz traversing the slates, though much attenuated in thickness, was exceedingly rich in quality.

* * * * *

"The richness of the quartz may be judged of from the fact communicated to me by Mr. Colin McDougall (a partner in one of the claims on which machinery is erected and in the prospecting claim), that from quartz crushed since June last in a small machine of eight stamps, and driven by water-power, a return of between £40,000 and £50,000 has been realized; 1,200 ozs. was the return from the same machine for the week preceding my visit, and 1,272 ozs. for the week following. In Drysdale and Co.'s, McDermott and Co.'s, and the Hope Company's claims, all situated adjacent to each other on the before-mentioned dyke, the quartz has proved to be exceedingly rich, but McDougall and Hurley are the only parties who have crushing machinery erected and at work; their claims, therefore, are the only ones that may be said, at present, to be producing returns.

"About two and a-half miles from Wood's Point, along the spur dividing the left-hand branch of the Goulburn from some small tributaries of the right-hand branch, a new reef, called the Waverley, had been discovered about a fortnight before my visit; and before I left no less than fifteen claims in succession, occupying a linear extent of more than a mile, were reported to have struck gold. This reef, so far as I was able to judge from the shallow depth to which any of the workings had reached, presented features still more singular than those of the Morning Star. The shaft which I examined (No. 1 North) exhibited the following descending section:—First, about twenty-six feet of a decomposed rock (more trappean than granitic), of a reddish or reddish-brown color, mottled with spots of pale dirty yellow, and containing crystals of white mica; then followed a seam or bed of auriferous quartz, six feet thick, and about four or five feet wide (the breadth of the reef); this was succeeded or underlaid by twelve feet of a brown-colored rock of the same texture and appearance as the first-mentioned, but more micaceous; beneath this was auriferous quartz, which had only been penetrated to a depth of two feet, and in which gold was plainly visible, though in fine particles. The quartz terminated, like the decomposed trappean rock, abruptly at the walls, and thus presented even more strikingly than the Morning Star the appearance of a horizontal *bed*."

This paper has a peculiar value, as bearing on some of the theories promulgated by the eminent geologist Sir Roderick I. Murchison, Bart.

In a letter published in the *Bendigo Advertiser*, on the 11th May, 1860, and written by Sir Roderick Murchison on the 27th February, 1860, he states that the chief auriferous rocks of Victoria are in the state of talcose slates, and that the sedimentary rocks have been metamorphosed on a great scale by outbursts of plutonic and igneous rocks. In order that he may not be misunderstood, it is well to give his statement in his own words:—

He says—"The metamorphosis on the great scale of ordinary deposits into crystalline rocks is, however, so constantly accompanied by numerous outbursts of granites, porphyries, greenstones, &c., that the latter rocks form part and parcel of the chains so metamorphosed. Such rocks are among the signs of the great heat which accompanied some of the changes effected. This connection is, indeed, so intimate, that no practical geologist can dissociate the phenomena from the occurrence of gold; for he sees that the igneous rocks, as well as the altered or crystalline deposits, are

auriferous, whilst deposits of precisely the same age which are not in that crystalline state, and have not been penetrated by such igneous rocks, never contain gold.

"Now, all the slates and quartzose rocks of lower silurian age in Australia are either crystalline or in association with intrusive rocks. They are, therefore, precisely in the condition of the silurian rocks of the Ural, with which I compared them. * * An original horizontal quartz vein is a rarity I have yet to discover."

It must be satisfactory to one who has labored so zealously in this department of science for so many years, to learn that in Victoria horizontal quartz veins are far from rare; and that not only the veins intersecting the altered and semi-crystalline deposits, but also those in the soft, unaltered fossiliferous shales, mudstones, and sandstones are highly auriferous.

Few persons who have not carefully examined volcanic tracts are acquainted with the effects produced by outbursts of lava and accumulations of heated matter on stratified rocks. It is believed that a vast mass of lava must necessarily greatly alter all the rocks with which it is brought in contact. This is an error. In those localities where the most recent lavas are found in great sheets as well as those where intrusive dykes of older basalt intersect the silurian mudstones, the effects of the outburst do not generally extend beyond a few feet; and in some places, close beside the dyke, casts of fossils in soft mudstone are to be found in abundance.

Where the silurian rocks are in contact with granites or porphyries, there are no clear indications in this colony of any changes having been effected by heat: it would appear that the sedimentary rocks have been altered by the infiltration from the neighboring rocks (more or less in a state of decomposition) of waters charged with silica, &c., and the limits to which such changes extend are in every case narrow. It must be understood distinctly this is not an argument put forward against the theory which maintains that the unstratified crystalline rocks were formed by igneous fusion. I state merely the facts as they occur under observation.

In order that independent testimony may be brought to bear on the question so ably discussed by Sir Roderick Murchison, the following extract from a report made by Mr. Aplin, the Government Geologist in Queensland, is given here. It is only necessary to read his statement, and to compare it with the latest account given by Sir R. Murchison of the modes of occurrence of gold, to convince the reader that I have touched on the theories of the English geologist in no captious spirit.

Mr. Aplin under date 18th November, 1868, says:—

"The appearance of the country (geologically) has already improved, the micaceous schists having given place to soft, laminated, argillaceous slates, the usual slates indeed with which auriferous quartz is associated on Victorian goldfields, and which I met with at Gympie also.

"As the result of the examination of the country I have traversed on this expedition since July, I am of opinion that the auriferous character of the quartz is more closely connected with the nature of the rocks amongst which quartz veins occur than with any supposed geographical distribution of the gold, irrespective of the rocks. My experience so far has led me to infer that amongst micaceous, talcose, and chloritic schists, even though of silurian age, productive quartz veins are not likely to be found; and that it is because the eastern slopes of the coast range are occupied by these rocks exclusively (with their subordinate intrusive masses), the quartz veins are barren and the gold wanting."

Mainly because it was believed that gold deposits could occur only near the centres of volcanic action, a vast area of this colony—Gippeland—was for years

neglected; but when our reefs were explored to great depths, and were found to yield gold in large quantities, faith in the predictions of those who had gained their experience in other lands was shaken, and one illusion destroyed, others became less potent, and finally tracts of auriferous country were opened up where gold, according to theory, should not be found. This, however, has perhaps been carried too far. Those parts of the colony which, according to the descriptions we have received, exactly resemble the Ural lie almost unprospected and unexplored. A great area, situate on the north-eastern confines of the colony, well watered by tributaries of the River Murray, and composed of metamorphic talcose slates abutting on granite—altogether more than 2,000 square miles—is yet, one may say, virgin ground. Let us hope that Sir Roderick Murchison's predictions will, as regards this part of the colony, be fulfilled, and that this now desolate region will some day become the chief centre of mining industry. If, as we are assured, the crystalline rocks are the great repositories of the precious metal, we have a future before us which will cast into the shade the past, rich and prosperous as it has been.*

It is unfortunate that the prospectors, who expended much time and labor within this area some years back, failed to find those rich deposits which beyond doubt exist, if we accept without hesitation the theories which have been promulgated.

There are three theories which, from the attention that has been bestowed on them, both in this country and in America, are deserving of notice here.

First, as regards the period during which gold was deposited in the veins, Sir Roderick Murchison says:—"We are led to believe that this noble metal, though for the most part originally deposited in, or diffused through, the mass of the ancient silurian sedimentary deposits, was only brought together into rich veins and separate lumps and strings at a comparatively recent period; i.e., a short time (in geological language) before the epoch during which powerful and widely-extended denudations took place, and during which the large extinct mammalia perished."

Secondly, as regards the distribution of gold in the veins:—"That deep mining in the solid quartz rock is usually unprofitable."

And thirdly, as regards the age of the rocks in which gold-bearing veins are likely to occur:—"Whilst all the stratified formations are composed either of

* As regards gold mining, we may learn patience and gather hope from the proceedings of the miners of England and Wales. Though it was well known that the quartz veins at Gogofau, and other parts of Wales, had yielded gold to the Romans, and that a piece of quartz with free gold in it had been obtained in Conwill Gaio by the officers of the geological survey some two and twenty years ago, it was not until 1861 that Mr. Robert Hunt, the Keeper of Mining Records in England, was able to include in the *Mineral Statistics of the United Kingdom* any actual returns of gold from a British mine.

From the returns published by Mr. Hunt, it appears that from 1861 to 1866 (inclusive, and including fifty tons, yielding 200 ozs., raised at Clogau prior to 1860) there have been crushed in the Dolgelly district of Merionethshire, 10,991 tons of quartz, which produced 14,381 ozs. 7 dwts. 1 gr. of gold, or an average of 1 oz. 6 dwts. 4·07 grs. per ton. This includes a parcel of 13 tons 16 cwt. 1 qr. 12 lbs. of quartz from Vigra and Clogau, which yielded 4,566 ozs. 2 dwts. 12 grs., or at the rate of 330 ozs. 9 dwts. 0·49 grs. per ton.

The neglect, during previous long years, of so much rich gold country is unaccountable, having regard to the means which exist in England and Wales for working and economically treating auriferous quartz. In Victoria a yield as low as 2 or 3 dwts. per ton will repay the quartz-crusher. If the Welsh miners were as energetic at home as they are in this colony, they would open up the veins at Gogofau, and set hundreds of stamp-heads at work. They would undoubtedly be richly rewarded.

crystalline and palæozoic rocks, or of secondary and tertiary deposits, gold has never been found in any appreciable quantity in either of the two last-mentioned classes of strata. The vast areas, therefore, which are covered by all such younger formations, are excluded from the application of our reasoning; and every one who lives in tracts, the subsoil of which consists of such rocks, may at once be assured that he can never profitably extract gold from them. * * * * *

"Appealing to the structure of the different countries which at former periods have afforded or still afford any notable amount of gold, we find in all a general agreement. Whether, referring to ancient history, we cast our eyes to the countries watered by the Pactolus of Ovid, to the Phrygia and Thrace of the Greeks, to the Alps and Golden Tagus of the Romans, to the Bohemia of the middle ages, to tracts in Britain which were worked in old times, and have either been long abandoned or are now scarcely at all productive, or to those chains in America and Australia which, previously unsearched, have, in our times, proved so rich, we invariably find the same constants in Nature. In all these lands gold has been imparted abundantly to one class only of those ancient rocks whose order and succession we have traced, or to the associated eruptive rocks."*

The first statement is not, apparently, supported by the evidence which has been collected in Victoria. No one doubts that the principal quartz veins of this country were formed long prior to the deposition of the mesozoic strata. These strata rest unconformably on up-edged denuded palæozoic rocks, which are everywhere penetrated by veins, and the veins do not extend upwards into the mesozoic rocks. The veins themselves afford proofs that the gold was deposited contemporaneously with the quartz, in most cases.† We find diffused throughout masses of hard, dense

* *Siluria*, p. 474-5, third edition.

† The older bed-rocks, permeated by meteoric waters, and exposed during vast immeasurable periods of time to all known forces—chemical, magnetical, and electrical—may be regarded as a laboratory; and it is more a matter for surprise that the strata are as little changed as they are, than that we should find in them only what we may call ordinate lines containing quartz and other minerals. Large areas of soft sandy muds and clays, everywhere full of palæozoic fossils, are streaked with veins of quartz, lying in regular order one parallel with the other; and though observing no signs of the metamorphism common elsewhere to rocks of the same age, it is yet not easy to free oneself suddenly from the old traditions, and to believe that the changes which have been produced are due to other forces than those always called into requisition by the popular writers on geology.

How has the quartz vein been formed, and in what manner has the gold been included in the vein-stone? Were the quartz and the gold deposited contemporaneously? Professor Bischoff helps with an answer.

"Gold, as he points out, certainly has a great affinity for silica, always being found in connection with it in mineral veins, in the drifts, and even in the pyrites, where I have always found silica as grains and minute nearly perfect hexagonal crystals, the occurrence of which I have always been at a loss to account for. The Professor's experiment is a very instructive one. He reports it as follows:—'On adding to a solution of chloride of gold a solution of silicate of potassa, the yellow color of the former disappears. After half an hour the fluid turns blue, and in time a dark-blue gelatinous precipitate appears, which adheres firmly to the vessel. After the lapse of some days, moss-like forms are to be seen on the surface of the precipitate, like an efflorescence. On exposure to sunlight no reduction takes place; but after the lapse of some months, if the precipitate is allowed to remain undisturbed under water, a decomposition takes place, and in the silicate appear minute partly-microscopical specks of gold.' If this is the method by which the gold reached the quartz lodes, as this Professor argues, *the origin of the silica is also that of the gold.*"—Cosmo Newbery, B. of Sc., in *Dicker's Mining Record*. The italics

quartz—twenty and fifty feet in thickness—particles of gold quite invisible to the naked eye; not in fissures, but in the compact vein-stone. We find also strings and rugged pieces of gold so closely intermixed with the quartz, and so obviously connected with the original form of the stone, as to forbid the assumption that the gold had been injected after the formation of the vein. If the gold had been deposited in the vein after it was formed and consolidated, we should have expected to find some signs of a fissure, or some traces of the force by which the cavity was formed; but there are none.

The diffusion of the most minute particles of gold in a solid mass of quartz is perhaps as difficult to explain on the hypothesis of subsequent impregnation, as any of the phenomena already described. Are there any forces known to the chemist which would be adequate to effect the dissemination of metallic gold in such a medium?

In laminated veins, we find veins of sulphide of iron and lead and antimony alternating with the quartz, and in the veins of sulphides numerous particles and lumps of gold. How could the quartz have maintained its position without the sulphides and the gold?

The layers are regular; and every part of the structure seems to show that the quartz, the sulphides, and the gold, were deposited gradually and contemporaneously.

It is not suggested that gold was diffused only during the period within which the principal reefs were formed. On the contrary, it would appear, from the condition of the rocks in this country, that it was deposited in fine flakes with the mud which forms palæozoic strata; and that it has been diffused in rocks throughout all geological ages. It has been proved, beyond doubt, that it is set free in modern accumulations.

It is found in pyrites in rocks of mesozoic age;* and Mr. H. A. Thompson states that "a beautiful specimen of crystallized iron pyrites, deposited on a piece of wood, taken from the drift immediately below the basalt at Ballaarat, gave by assay 40 ozs. of gold per ton; and in another case, where only the pyrites from the centre of an old tree trunk was examined, the yield was over 30 dwts. of gold per ton."

The question is one of high importance, and while it is right to receive the statement of Sir Roderick Murchison's opinions with that respect which is due to so high an authority, we should not shut our eyes to the facts before us; nor, on the

are mine, because the closing sentence touches one of the most important questions which the miner in this colony has to consider.

It is easy to conjecture that the meteoric waters, acting in obedience to chemical laws, would be less effective in the hard, compact, and tough plutonic rocks, than in the soft, easily-permeated mudstones and shales which compose the great mass of the fossiliferous silurian rocks of this country. Mr. Ulrich informs me that dark-blue, almost gelatinous, substances have been found in quartz veins near Malmesbury, which, on exposure to the atmosphere, have shown gold in minute particles everywhere on the outer surface.

* A. R. C. Selwyn, Esq. *Geology and Mineralogy of Victoria*, p. 17. Mr. Selwyn states that a small sample of pyrites obtained from the dark shales (which are plentiful) of the mesozoic epoch, and assayed at the Geological Survey Laboratory, yielded gold equal to 6 dwts. 18 grs. per ton; a yield greater in fact than that of many reefs now profitably wrought. "With reference to this question, I must be allowed to state my opinion, that the coal group does contain alluvial gold, but not available to the miner, as the enormous thickness and induration of the strata prevent a 'bottom' being sought where the most gold would be likely to be found."—7. *Mesozoic Carbonaceous Epoch. Report of Mr. Richard Daintree, Field Geologist, 21st May, 1863.* In another part of his report, Mr. Daintree describes a section where the mesozoic rocks are seen resting on the palæozoic; and the quartz reefs intersecting the latter do not pass into the overlying conglomerates.

other hand, should we too rashly conclude that the evidence is wholly adverse to his theory. Had this eminent geologist the opportunity afforded him of personally inspecting our reefs, it is probable that he would easily settle many intricate questions which others, not possessed of his ability and experience, might find it impossible to solve.

The theory advanced by Sir Roderick Murchison, relative to the mode in which quartz veins have been impregnated with gold, requires for its support that the quartz veins should yield gold in large quantities only near the surface; that with an increase of depth there should be a corresponding decrease in the yield; and that deep mining in the solid quartz rock should be unprofitable.

In this statement, as given in the third edition of *Siluria*, there is some confusion of terms. Neither in this colony, nor in America, is there any deep mining in quartz rock. All our experience of this sort has reference to mining in *vein quartz*; and from the context it would appear that Sir Roderick Murchison means to indicate *vein quartz*.

It would be unfair to suppose that this far-sighted geologist rested his theory on the few uncertain results which were obtained in the Ural, prior to the discovery of gold in California and Australia. A mere scratching of the surface is not sufficient to settle a matter of this kind; nor indeed would negative results, however numerous, entirely satisfy the mind, so long as it was obvious that many veins were left untried. It would be possible to sink a hundred shafts in Victoria, which would give very poor results, both on the surface and at great depths, just as it is possible to sink deep shafts in coal-bearing rocks and get no coal. These are accidents; and as regards quartz veins, it is necessary to show that all of them become poorer as the depth increases, in order to bring the results out of the category of accidents.

If it be a *law*, circumstances everywhere should conform to it; and if it be a *rule*, in the majority of instances the quartz should become poorer. In this colony, though quartz mining is, one may say, but hardly commenced, there is no reason to believe that, as a rule, the reefs decrease in richness with the increase of depth.

On the older goldfields, quartz taken from a depth of 600 feet has yielded as much as 4 ozs. to the ton; and in the Good Hope mine, at Crooked River, quartz of extraordinary richness, everywhere studded with gold, has been taken out of the mine at a depth of nearly 500 feet from the crown of the reef.

It is generally believed that while the average yield is the same for all depths, the gold near the surface is most often aggregated in strings and lumps; that the veins widen as the depth increases; and that in the larger spaces the gold is more generally diffused throughout the vein-stone. This is true of some mines, but not of all. It is possible to gather from some of our reefs as rich specimens at great depths as any that are commonly found on the surface.*

* Mr. R. H. Bland, and Capt. Couchman, the Chief Mining Surveyor, have frequently called attention to the mode in which gold is generally distributed in our veins, and have explained how the impression, that reefs become poorer as the depth from the surface increases, originated. In many quartz lodes the auriferous vein-stuff is confined to bands which dip along the strike of the vein, and the intervening spaces are either destitute of gold or very poor. When one of these bands has been cut and the quartz excavated, and the shaft is sunk to a greater depth, the yield falls off, the mine is abandoned, and fresh evidence in support of the old theory is at once communicated. But when, owing to the results of operations in neighboring mines, the ground is again taken up, and the shaft is sunk still deeper, a new band of auriferous vein-stuff is cut. Hustler's Reef, at Sandhurst, and some of the reefs at Clunes, exhibit this peculiarity.

The following statement of the yields at different depths has reference to the mines of this colony, and proves sufficiently that we have no cause to fear that our reefs will cease to yield gold at any depths to which we shall be able to penetrate. They confirm the observations made in California, where quartz mines more than 1,200 feet in depth are now profitably wrought.

FROM 600 FEET AND DEEPER.

The Temperance Company, at Little Bendigo, Ballaarat, obtained 770 tons of quartz from between levels of 580 and 650 feet in depth, which yielded nearly 11 dwts. of gold per ton; and from levels 500 and 650 feet in depth 910 tons of quartz were raised, which gave an average yield of 16 dwts. to the ton.

The Victoria Company, Clunes, crushed 4,143 tons of quartz obtained from the 660 feet level, which yielded nearly 10 dwts. per ton; 4,550 tons, from levels as deep as 640 feet, which yielded nearly 13 dwts. of gold per ton; and from levels of 630 feet in depth 7,004 tons were crushed, which yielded an average of $6\frac{1}{2}$ dwts.

A crushing from the New North Clunes Company's mine of 45 tons, obtained at levels 600 feet in depth, yielded $3\frac{3}{4}$ dwts. per ton. (It was raised from the Robinson's Reef, which proved at this spot to be ten feet in thickness.)

The Mariner's Reef Company, Maryborough, crushed 176 tons of quartz, raised from levels 600 feet in depth, which yielded very nearly 4 ozs. of gold per ton.

FROM 500 TO 600 FEET.

The Sisters Company, at Little Bendigo, near Ballaarat, crushed 200 tons, obtained from the 567 feet level, which yielded 96 ozs. 18 dwts., or an average of upwards of $9\frac{1}{2}$ dwts. to the ton; and 1,230 tons of quartz, got from between 520 feet in depth and the 567 feet level, yielded nearly $7\frac{1}{4}$ dwts. of gold per ton.

The Port Phillip Company, at Clunes, crushed 14,082 tons of quartz, raised from levels as deep as 517 feet, which yielded an average of over 11 dwts. 19 grs. per ton.

From a crushing of 3,700 tons of quartz, won at the 550 feet level by the Victoria Company, at Clunes, 1,654 ozs. of gold were obtained, being nearly 9 dwts. per ton. Other crushings of 3,365 tons, got from the 500 feet level, averaged 6 dwts. 15 grs. per ton; and 3,920 tons, taken from the 570 feet level, averaged 6 dwts. 20 grs. per ton.

The Temperance Company, Little Bendigo, crushed 600 tons, obtained from the 550 feet level, which produced an average of over $7\frac{1}{2}$ dwts. to the ton.

At Carngham the Britannia Company raised 2,227 tons of quartz, from 500 feet in depth, which yielded 528 ozs. 16 dwts. 18 grs., or an average of nearly 4 dwts. 18 grs. per ton. The quartz was obtained at a depth of 500 feet; and, comparing the average yield with that at lesser depths, it appears that the quality of the stone is improving. For instance, for the quarter ending 31st December, 1865, at a depth of from 280 to 340 feet, the average yield was 4 dwts. 13.20 grs.*

From levels of 570 and 590 feet in depth the Mariner's Reef Company, Maryborough, raised 65 tons of quartz, which yielded 221 ozs., or an average per ton of 3 ozs. 8 dwts. (35 tons of the 65 were raised from 590 feet, and yielded an average of 5 ozs. 8 dwts. per ton); and 30 tons, taken from a vein in the same reef, at a depth of 560 feet, yielded at the rate of 5 ozs. $6\frac{3}{4}$ dwts. of gold per ton. This vein was ten inches in thickness.

* *Mining Registrar's Report*, quarter ending 31st December, 1866, p. 7.

The Kangaroo Company, Ararat, raised 1,200 tons of quartz, from the 500 feet level, which yielded 8 dwts. to the ton.

With reference to the Cross Reef, and the increased yield of gold in depth, the Mining Registrar for the Pleasant Creek Division makes the following observations, in his report for the quarter ending 30th June, 1866, page 76 :—"The new formation of the Cross Reef has been successfully traced through several claims, which, for some time back, were considered completely worked out, the stone increasing in richness as it has been followed from the point at which it was first struck, in Lamont and Co.'s claim, No. 5 North, at a depth of 500 feet from the surface—the payable stone then being not more than eight inches in thickness, and giving but 10 dwts. to the ton—to No. 2 North, where it shows a well-defined lode seven feet in thickness, and yielding $1\frac{1}{2}$ oz. to the ton. Within the last month the continuation of this reef, in the opposite direction, has been struck by driving in claim No. 7 North, at a depth of 560 feet from the surface." In his report for the quarter ending 31st March, 1868, page 33, the registrar states that the payable stone in the Cross Reef has been traced one claim farther to the north, where the encouraging yield of 1 oz. per ton was obtained from the 550 feet level.

The Good Hope Company, Crooked River, raised 634 tons of quartz, from a level 500 feet in depth, which yielded nearly 3 ozs. $17\frac{1}{2}$ dwts. per ton. There is a large quantity of equally rich stone still in sight to be taken out above the present level, while that under foot looks quite as good. Tenders have been called for, to drive another level 200 feet below the last, or at a depth of 700 feet from the surface.*

At Harrietville, the Rose, Thistle and Shamrock Reef yielded 9 dwts. to the ton, from 300 tons of quartz obtained at the 560 feet level; and 5 dwts. to the ton from 771 tons broken from the 500 feet level.

From the 500 feet level the Kangaroo Company, at Ararat, raised 1,740 tons of quartz, which yielded an average of $\frac{3}{4}$ oz. to the ton, and the reef was two feet six inches in thickness.

From between 440 and 620 feet in depth the Yankee Company, at Clunes, raised 2,156 tons, which yielded over 4 dwts. to the ton.

The Portuguese Reef, at Steiglitz, yielded, to the Albion Company, 915 tons of quartz, from between the 475 and 575 feet levels, which averaged nearly $2\frac{1}{2}$ ozs. of gold per ton. The mining registrar reports, in March, 1868, that :—"The prospects of this claim can only be described as splendid. At the 330 feet level a run of gold has been found richer than ever known before, and at the depth of 575 feet the lode looks equally promising."†

The Kangaroo Company, at Ararat, raised 669 tons, from between the 425 feet and 505 feet levels, which yielded 459 ozs., or an average of over $13\frac{1}{2}$ dwts. per ton.

A crushing of 865 tons raised from between the 474 and 567 feet levels in the Sisters Company, Little Bendigo, yielded 430 ozs. 6 dwts., or an average per ton of very nearly 10 dwts.

The Mariner's Reef Company, Maryborough, raised 83 tons of quartz, from between 550 and 600 feet in depth, which averaged over 5 ozs. 3 dwts. per ton.

* *Mining Registrar's Report*, quarter ending 31st March, 1868, p. 35.

† *Mining Registrar's Report*, for the quarter ending 31st March, 1868, p. 9.

The mining registrar for the division makes the following remarks respecting the operations of this company :—

“The yields from the different reefs have been of a satisfactory character, and the handsome yield out of No. 1 Claim, Mariner’s Reef, at a depth of from 550 to 600 feet (the reef being from two to three feet), is entitled to special attention :—

	£	s.	d.
83 tons realized - - - - -	1,680	0	0
300 tons casing realized - - - - -	281	14	0
	£1,961	14	0

Cost of raising quartz.

Sinking shaft ten feet deeper for this purpose - -	80	0	0
Raising quartz, seven men, thirteen days, at £2 10s.			
each per week - - - - -	37	18	0
Pumping expenses for twenty-three days, at £3 per day	69	0	0
	£186	18	0

Thus realizing to the company, in twenty-three days, a profit of £1,774 16s.”

FROM 400 TO 500 FEET.

At Little Bendigo the Sisters Company crushed 2,763 tons of quartz, which were extracted from levels between 429 and 470 feet in depth, and the yield of gold was 6½ dwts. per ton.

The Temperance Company, at Little Bendigo, crushed 800 tons, which yielded 6½ dwts. of gold to the ton, obtained from levels between 400 and 550 feet in depth.

A crushing of 350 tons of quartz got from the 450 feet level in the Band of Hope Company, Little Bendigo, yielded nearly 5 dwts. to the ton; and 520 tons, obtained from 430 feet in depth, yielded an average of over 5½ dwts. to the ton.

The Britannia Company, at Carngham, raised 5,534 tons of quartz, from levels between 400 and 412 feet in depth, which yielded an average of over 4 dwts. 10 grs. per ton.

The Port Phillip Company, at Clunes, crushed 12,918 tons of quartz obtained from levels as deep as 444 feet, which yielded 3,897 ozs. 13 dwts., or an average of over 6 dwts. per ton.

The Victoria Company, Clunes, obtained a yield of nearly 6 dwts. per ton, from 2,898 tons of quartz raised from the 406 feet level; and, from the 460 feet level, 2,814 tons yielded an average of 4 dwts. 11 grs. per ton.

The Albion Company, at Steiglitz, raised 520 tons of quartz, from levels between 480 and 500 feet in depth, which yielded 320 ozs. of gold, or an average of over 12½ dwts.; other crushings, from levels between 400 and 497 feet in depth, of 162 tons of quartz, yielded an average per ton of over 2 ozs.—of 464 tons, an average per ton of over 2 ozs. 18 dwts.—and of 808 tons, an average of over 3 ozs. 4½ dwts. The manager, in his report, says :—“The yield of gold has been steadily increasing with the depth of the vein, and at the depth of 400 feet the average yield (9½ ozs.) is more than at any crushing since the formation of the company.”

The following remarks relative to the Albion Company, are taken from the Mining Registrar’s Reports for the Steiglitz subdivision, for the quarters ending June 30th, and September 30th, 1867 :—“On reference to the tabulated statement, it

will be seen that the quartz crushed by the Albion Company was obtained at a depth varying from 430 to 497 feet, a pretty fair proof that the theory of a decreasing yield of gold with an increasing depth of lode worked, does not apply in this instance. The quartz crushed has been taken out for a distance of 350 feet along the lode, and the yield of gold may be considered as the average of the lode for the length named. One-half of the quantity crushed was the casing and small mullock from the sides of the solid quartz, which were formerly thrown away, but since the erection of the new battery everything has been crushed; had the solid quartz alone been crushed, the average yield would have been about (7 ozs.) seven ounces per ton, the casing, small mullock, &c., averaging about $2\frac{1}{2}$ dwts. to the ton. The last fortnight's crushing during the quarter was 89 tons, yielding 424 ozs. 5 dwts. of gold, and the mining manager is sanguine as to future crushings being equally good. This company takes the lead of all others on the field, and from present appearances seems likely to retain it. The reef in the levels at present worked continues wide and massive, and highly auriferous. The sinking of the main shaft to a depth of another 100 feet will be completed almost immediately, making a total of 600 feet. The mining manager is sanguine that a large body of auriferous stone will be opened out, which will keep the battery going for many months to come, and prove very profitable to the shareholders."

From the Portuguese Reef, the Albion Company obtained 1,087 tons of quartz, which yielded over 2 ozs. 4 dwts. per ton; it was raised from the 473 feet level.

The Homeward Bound Company, Stanley, raised 550 tons from 400 feet in depth, which yielded 18 dwts. per ton; from the 420 feet level, 345 tons, which averaged nearly 15 dwts. 9 grs. per ton; 185 tons, which averaged over 18 dwts.; and subsequently 80 tons, which yielded 8 dwts. to the ton.

A crushing of 80 tons obtained from the 400 feet level, on the Rose, Thistle, and Shamrock Reef, Buckland, averaged 3 ozs. to the ton; and of 443 tons, yielded $15\frac{1}{2}$ dwts. to the ton.

The Johnson's Reef Company, at Sandhurst, got 6,546 tons of quartz from between the 422 and 475 feet levels, which produced nearly 7 dwts. of gold to the ton; and 159 tons from the 422 feet level yielded over 3 ozs. of gold per ton.

The Mining Registrar for the Sandhurst Division says:—"The most satisfactory feature is the quartz on many of the main lines being richer at greater depths than nearer the surface. The Hustler's line presents an instance of this fact: the yield from Messrs. Latham and Watson's claim, at 450 feet level, is said to be richer than any previous returns from the same mine.

On this line the Hustler's Reef Company, after sinking 400 feet, put in a drive and cut the reef, which looks well. The operations of this company for the last few months have enabled them to discharge a liability of some thousands of pounds incurred in the erection of their new machinery. The Comet Company's stone is improving, and their crushings are highly satisfactory. Further north the Alabama Company are erecting a pumping, winding, and crushing machine, and sinking a new main shaft (now 170) 300 feet deep, to cut the reef which has been worked in the old shafts."

Wetherall Reef, Sandhurst: the Collmann and Tacchi's Reef Company have struck a good reef in their claim at a depth of 450 feet. The last crushing of 180 tons from it yielded 508 ozs. of gold, or over $2\frac{3}{4}$ ozs. to the ton.†

* *Mining Registrar's Report*, quarter ending 31st December, 1866, p. 39.

† *Mining Registrar's Report*, quarter ending 31st March, 1868, p. 18.

At Maryborough, the Phoenix Company raised 599 tons of quartz, from the 400 feet level, which yielded an average of over $3\frac{1}{4}$ dwts. to the ton.

Williams, Brothers and Co., Maryborough, crushed 390 tons of quartz, which were broken from the 420 feet level, and gave an average yield of 13 dwts. of gold per ton.

A crushing of 482 tons of quartz, from the 400 feet level on Thornhill's Reef, Maldon, averaged 15 dwts. to the ton.

Three hundred and fifty-seven tons were obtained, from levels as deep as 436 feet, on the Beehive Reef, Maldon, which yielded over $\frac{1}{2}$ oz. to the ton.

Campbell's Reef, at Moyston, proved to be very rich between levels as deep as 400 and 450 feet. Various companies crushed 4,512 tons of stone, which yielded an average of 1 oz. 2 dwts. 16 grs. per ton. Two lots, of 224 tons and 402 tons, included in the above crushing, yielded averages of 2 ozs. $2\frac{1}{2}$ dwts., and 1 oz. 12 dwts. 19 grs., respectively.

The Kangaroo Company, at Ararat, raised 507 tons from the 450 feet level, which yielded an average per ton of nearly 1 oz. 3 dwts. Other crushings, from this mine, of 1,500 tons from the 500 feet level, produced over $6\frac{1}{2}$ dwts. to the ton; of 2,500 tons, obtained from levels between 425 feet and 505 feet in depth, yielded 2,000 ozs. of gold, or an average of 16 dwts. per ton; and of 1,889 tons of quartz, got from levels 425 feet in depth, a yield was obtained of very nearly 15 dwts. to the ton.

A crushing from the Extended North Star Company's claim, Ararat, of 612 tons of quartz, yielded an average of over 18 dwts. to the ton. The quartz was obtained from a level at 420 feet in depth, the width of the reef being two feet.

The Southern Cross Company, Ararat, crushed 1,046 tons, and 1,950 tons of quartz, raised from the 410 feet level, which yielded respectively 15 dwts. 17 grs., and very nearly 16 dwts. of gold to the ton. From levels as deep as 400 feet, 440 tons of quartz were broken, which produced over $\frac{1}{2}$ oz. to the ton.

The Cross and Flat Reefs, at Pleasant Creek, at the 400 and 460 feet levels, yielded 1 oz. per ton from over 4,000 tons of quartz crushed.

The Moonlight Company, Pleasant Creek, obtained 1,224 tons of quartz, from levels 460 feet in depth, which averaged over 1 oz. to the ton; and another crushing raised by this company, from the 400 feet level, of 1,329 tons, yielded over 1,052 ozs. of gold, or an average of nearly 16 dwts. to the ton.

A crushing from the Pleasant Creek Company, of 1,260 tons of quartz, got from the 400 feet level, yielded an average of 19 dwts. per ton.

The Flat Reef, Pleasant Creek, yielded 2,124 tons of quartz, raised from levels 460 feet in depth, which gave an average of over 15 dwts. per ton.

The Good Hope Company, Crooked River, raised 247 tons of quartz, from the 490 feet level, which yielded nearly 3 ozs. 18 dwts. to the ton.

INTERMEDIATE DEPTHS.

The Temperance Company, Little Bendigo, raised 2,140 tons of quartz, which yielded an average of over 13 dwts. 16 grs. The quartz was obtained from levels between 300 and 530 feet in depth.

At Steiglitz the Albion Company broke 892 tons of quartz from the Portuguese Reef, at levels as deep as 320 and 573 feet, which yielded 2,495 ozs. 18 dwts. of gold, or an average of very nearly 2 ozs. 16 dwts. per ton.

Crushings of quartz, amounting to 3,049 tons, raised by the Johnson's Reef Company, Sandhurst, from the 250, 422, and 450 feet levels, yielded 5,566 ozs. 16 dwts. of gold, or an average per ton of over 1 oz. 16½ dwts.

The Energetic Company, Victoria Reef, Sandhurst, obtained 68 tons of quartz, from between levels 380 and 435 feet in depth, which gave an average of nearly 3 ozs. of gold per ton.

The Collmann and Tacchi's Reef Company, at Sandhurst, got 319 tons of quartz, from levels of 388 and 450 feet in depth, which gave an average yield of nearly 2 ozs. 3 dwts. to the ton.

From the Cross and Scotchman's Reefs, Pleasant Creek, Lamont and Co. raised 2,186 tons of quartz, from between the 300 and 560 feet levels, which gave, when crushed, nearly 1 oz. 17 dwts. per ton; and 2,717 tons, from between the 300 and 600 feet levels, which yielded nearly 1 oz. Another crushing of 2,404 tons of quartz, raised from levels as deep as 300 and 562 feet, yielded an average of over 1 oz. 1 dwt. to the ton.

FROM 300 TO 400 FEET.

From levels as deep as 340 feet the Band of Hope Company, Little Bendigo, obtained 567 tons of quartz, which gave 422 ozs. of gold, or nearly ¾ oz. to the ton.

The One-and-All Company, Little Bendigo, crushed 180 tons of quartz, which yielded an average of over 15½ dwts. per ton. The stone was got from levels 360 feet in depth. Other crushings, amounting in the aggregate to 710 tons, raised from levels 350 feet in depth, yielded an average of very nearly 12½ dwts. per ton.

The Llanberris Company, Gum-tree Flat, raised 16,284 tons of quartz, from the 300 feet level, which yielded an average of over 3½ dwts. per ton; and 4,829 tons, broken from the same level, yielded over 3 dwts. per ton.

The Imperial Company, Buninyong, raised 2,805 tons of quartz, from the 320 feet level, which yielded over 5 dwts. of gold to the ton; 1,955 tons and 6,085 tons, from the same level, yielded respectively nearly 5 dwts. and 3 dwts. to the ton. The only reef at present worked is Hiscock's, on which there are four companies. The greatest depth yet attained is by the Imperial Company, who raise the quartz from a depth of 320 feet; and at this depth the stone shows an improvement of fully ½ dwt. per ton. The Standard Claim is now being worked by a co-operative company, who have been very successful, having struck quartz of a much richer character than that which the old company had obtained for a long time previous. The Erin-go-Bragh Company, the most southern on this reef, are getting quartz superior to any yet obtained, averaging over ¼ oz. to the ton.*

The Port Phillip Company, at Clunes, crushed 30,403 tons of quartz, which yielded 9,031 ozs. 14½ dwts., or an average of nearly 6 dwts. per ton. The quartz was got from levels as deep as 374 feet. Other crushings, amounting to 26,354 tons, obtained from levels as deep as 300 and 374 feet, yielded a total of 10,119½ ozs., or an average of more than 7½ dwts. per ton.

The Albion Company, Steiglitz, crushed 80 tons of quartz, which were broken from levels 320 feet in depth, and gave an average of 2½ ozs. per ton.

The Redan Company, Steiglitz, raised 793 tons, from levels 315 feet in depth, which yielded over 4½ dwts. per ton.

* *Mining Registrar's Report*, quarter ending 30th June, 1867, p. 6.

From between levels 300 and 380 feet in depth, the New Ballaarat Company, at Steiglitz, raised 696 tons of quartz, which yielded over $4\frac{1}{2}$ dwts. per ton.

At Carngham, the Britannia Company obtained an average yield of upwards of $5\frac{1}{2}$ dwts. to the ton, from 3,198 tons of stone, taken from different levels, reaching to a depth of 340 feet. It is reported that the quality of the stone does not vary in any material degree at the different levels.

From the Excelsior Reef, Beechworth, Henderson and Co. obtained 51 tons, from the 300 feet level, which yielded 1 oz. $7\frac{1}{2}$ dwts. to the ton.

The Homeward-bound Company, Rocky Point, Stanley, got 45 tons, from the 300 feet level, which gave 3 ozs. 1 dwt. per ton. The reef at this depth was two feet in thickness.

From the Rose, Shamrock, and Thistle Reef, Buckland, McLean, Wallace, and Co. raised 1,910 tons of quartz, from the 300 feet level, which yielded over 5 dwts. to the ton.

The United Company, at Wood's Point, broke from the Morning Star Reef 196 tons, from levels as deep as 330 feet, which gave an average yield of $16\frac{1}{2}$ dwts. per ton.

From the Hustler's Reef, Sandhurst, 393 tons of quartz, raised from levels 320 feet in depth, yielded over 1 oz. to the ton; and 70 tons, from the same depth, yielded nearly 15 dwts. to the ton.

Twelve hundred tons of quartz, broken in the Hercules Company's mine, Sandhurst, at a depth of 350 feet, yielded an average per ton of over 6 dwts. From the same level and mine another parcel of 400 tons was raised, which gave an average of nearly 7 dwts. per ton.

The Energetic Company, Victoria Reef, Sandhurst, raised 851 tons of quartz, from levels 340 feet in depth, which yielded 3,604 ozs. 1 dwt. of gold, or an average per ton of over 4 ozs. $4\frac{2}{3}$ dwts.; other crushings, broken from levels as deep as 305 feet, of 105 and 55 tons respectively, yielded $14\frac{1}{2}$ ozs. per ton and over $23\frac{1}{2}$ ozs. per ton. From this mine 35 tons, got from the 380 feet level, gave over 4 ozs. 14 dwts. of gold to the ton.

From the Victoria Reef, Sandhurst, 54 tons of quartz were crushed, which yielded over 3 dwts. to the ton. The quartz was broken at the 330 feet level.

Fifteen hundred and fifty-eight tons of quartz were broken from the New Chum Reef, Sandhurst, between levels of 312 and 340 feet in depth, and produced very nearly 1 oz. to the ton.

From levels as deep as 325 feet, the Johnson's Reef Company, Sandhurst, obtained 116 tons of stone, which gave an average of 18 dwts. per ton.

From the American Reef, Sandhurst, 30 tons of quartz, raised from the 300 feet level, yielded nearly 2 ozs. 7 dwts. of gold to the ton.

Forty-three tons obtained from the Wetherall Reef, Sandhurst, at levels as deep as 388 feet, yielded nearly $1\frac{1}{2}$ oz. to the ton.

The Argus Company, Sandhurst, obtained over 2 ozs. 13 dwts. per ton from 151 tons of quartz, from the 300 feet level.* Two specimens, picked out of their stuff, yielded £45 worth of gold.

The Hit or Miss Company, Redcastle, obtained, from the 300 feet level, a lot of 35 tons of stone, which gave an average of nearly 5 ozs. to the ton.

* *Mining Registrar's Report*, quarter ending 31st December, 1867, p. 18.

Clarke's Welcome Reef, Redcastle, crushed 56 tons, obtained from the 300 feet level, which yielded nearly 3 ozs. to the ton.

The Alabama Company, Heathcote, obtained 374 tons of quartz from the 300 feet level, which gave an average yield of over $1\frac{1}{2}$ oz. to the ton; from levels between 300 and 330 feet in depth, 493 tons, which gave over 2 ozs. per ton; and other crushings amounting to 912 tons, raised from between levels 360 and 400 feet in depth, produced 1,112 ozs. of gold, or an average of nearly $1\frac{1}{4}$ oz. per ton; and 383 tons broken from levels 340 feet in depth, yielded an average of 19 dwts. 12.72 grs. per ton.

The Costerfield Company, Heathcote, broke 914 tons from levels 300 feet in depth, which yielded an average of over 10 dwts. per ton.

From the Blucher's Reef, Maryborough, 3,255 tons of quartz were broken from levels 300 feet in depth, which yielded an average of over $\frac{1}{2}$ oz. to the ton.

At the 320 feet level, 1,510 tons of quartz were obtained from Blucher's and Ironstone Reefs, Maryborough, which yielded an average of nearly $\frac{1}{2}$ oz. per ton.

The Phoenix Company, Maryborough, raised from the 300 feet level 100 tons, which yielded over $12\frac{1}{2}$ dwts. to the ton.

Williams Brothers and Co., Maryborough, crushed 520 tons of quartz, obtained from the 320 feet level, which gave 16 dwts. to the ton.

From levels 325 feet in depth, Houghton and Company, Frederick's, Maryborough, raised 360 tons, which produced an average of $4\frac{1}{2}$ dwts. to the ton.

A parcel of 410 tons of stone, got from levels 385 feet in depth, was obtained from the old prospecting claim on Poverty Reef, Tarnagulla, which yielded an average of over 1 oz. to the ton. From the same reef, 1,699 tons were broken from the 320 feet level, which gave an average of over 7 dwts. to the ton.

The New Chum Reef, Dunolly, yielded 160 tons of quartz from levels as deep as 305 feet, which gave an average of 1 oz. 14 dwts. per ton; and 1,080 tons from the 300 feet level gave over 1 oz. 3 dwts. to the ton; the reef being eight feet in thickness; and from the last-mentioned level 700 tons yielded nearly 1 oz. 9 dwts. of gold to the ton.

At Hepburn, the Havelock Company crushed 1,500 tons, broken from levels between 300 and 350 feet in depth, which produced over 7 dwts. of gold per ton.

Dannevirke and Company, Hepburn, raised 70 tons, which yielded over 18 dwts. per ton, from levels 360 feet in depth.

The Union Company, Eaglehawk Reef, Maldon, broke 2,189 tons of quartz, from levels 300 feet in depth, which yielded nearly $1\frac{1}{2}$ oz. per ton.

The Union Company, Muckleford, raised, from levels 360 feet in depth, 1,050 tons of quartz, which yielded over 6 dwts to the ton.

A crushing of 928 tons of quartz, obtained from levels 340 feet in depth, in the Phoenix Company's mine, Maldon, yielded 2,039 ozs. 10 dwts. of gold, or an average of over 2 ozs. 3 dwts. per ton. From the same depth another crushing of 925 tons was won, which yielded very nearly 2 ozs. per ton.

The Albert Company, Maldon, crushed 746 tons of quartz, obtained from the 300 feet level, which yielded nearly 5 dwts. to the ton; and 191 tons, which gave nearly $8\frac{1}{2}$ dwts. to the ton; and from the 300 and 400 feet levels 756 tons, which yielded over 13 dwts. of gold to the ton.

At Thornhill's Reef, Maldon, a lot of 146 tons of stone was obtained from levels of 310 feet, which yielded an average of about $1\frac{1}{2}$ oz. per ton.

At Nuggety Reef, Maldon, from levels at a depth of 300 feet, 1,212 tons were obtained, which yielded 902 ozs., or an average of nearly 15 dwts. per ton.

The Eaglehawk Company, Maldon, raised 1,025 tons from the 300 feet level, which yielded about $6\frac{1}{2}$ dwts. per ton.

The Eaglehawk Unior Company, Maldon, obtained 1,295 tons of quartz from the 300 feet level, which yielded an average of upwards of $3\frac{1}{2}$ ozs. per ton.

The Nelson Company, Maldon, crushed 774 tons of quartz, which were raised from the 300 feet level, and the yield was more than 2 ozs. to the ton.

From crushings of quartz, amounting in the aggregate to 2,600 tons, in the Southern Cross Company's mine, at Moyston, a yield of over 14 dwts. to the ton was obtained, and the quartz was broken out at levels 330 feet in depth.

The Moonlight Company, Pleasant Creek, obtained 808 tons, from the 360 feet level, which yielded more than $\frac{1}{2}$ oz. per ton; and 1,450 tons, from between the 300 and 500 feet levels, which yielded 16 dwts. to the ton.

The Rose of Denmark Company, at Pleasant Creek, obtained an average of nearly $13\frac{1}{2}$ dwts. per ton from 1,766 tons, got at levels 320 feet in depth.

At 360 feet in depth the St. George's Company, Pleasant Creek, got 906 tons of quartz, which averaged over $11\frac{1}{2}$ dwts. per ton; and from levels as deep as 320 feet 2,883 tons, which gave an average of over 1 oz. 8 dwts. per ton.

From 300 feet in depth the Victoria Company, Pleasant Creek, raised 200 tons, which yielded over 1 oz. $3\frac{1}{2}$ dwts. per ton; and from levels 300 and 400 feet in depth the same company crushed 1,294 tons, which yielded over 1 oz. to the ton.

From the Cross and Scotchman's Reefs the Pleasant Creek Company got 1,835 tons, from a depth of 319 feet, which yielded an average of over 17 dwts. per ton.

The Scotchman's Reef, Pleasant Creek, produced 2,143 tons, from the 300 feet level, which yielded over $\frac{3}{4}$ oz. to the ton; other crushings of 1,762 tons and 450 tons, obtained from levels 319 feet in depth, gave averages of 16 dwts. and 1 oz. per ton respectively.

The Wimmera Company, Pleasant Creek, raised 3,731 tons of quartz, from levels 320 and 350 feet in depth, which yielded over 1 oz. to the ton.

The Good Hope Company, Crooked River, crushed 859 tons, which yielded 1,589 ozs., or an average of very nearly 1 oz. 17 dwts. per ton. The quartz was raised from levels 300 feet in depth. The Good Hope Company's claim is still improving. It has been tested to a depth of 300 feet. Nearly £10,000 worth of gold has been taken out of this claim in the last six months, less than half of which has paid all the working expenses.* A crushing of 639 tons of quartz, obtained from levels 350 feet and 500 feet in depth, gave an average of nearly 3 ozs. 6 dwts. to the ton.

INTERMEDIATE DEPTHS.

The Llanberris Company, Gum-tree Flat, crushed 5,087 tons, raised from levels between 200 and 350 feet in depth, which yielded nearly $3\frac{1}{2}$ dwts. to the ton.

The Port Phillip Company, at Clunes, raised 16,095 tons, from levels between 228 and 444 feet in depth, which yielded over 9 dwts. to the ton.

McLean and Company, Buckland, from levels between 200 and 500 feet, raised 810 tons, which averaged $7\frac{1}{2}$ dwts. per ton.

At Sandhurst, the Hercules Company crushed 540 tons, from levels between 280 and 350 feet in depth, which yielded an average of over 6 dwts. to the ton, the reef

* *Mining Registrar's Report*, for quarter ending 30th June, 1866, p. 25.

being fifteen feet in thickness. This company raised 650 tons, from levels between 350 and 410 feet in depth, which yielded over 8 dwts. per ton.

The Ellesmere Company, Sandhurst, obtained 1,729 tons of quartz from the New Chum Reef, from between levels of 270 and 340 feet in depth, which gave over 10 dwts. of gold to the ton.

The Comet Company, Redan Reef, Sandhurst, crushed 3,160 tons of quartz, broken from levels near the surface downward to 450 feet in depth; it yielded nearly 10 dwts. of gold to the ton.

The Rose of Denmark Company, on the Robert Burns Reef, Sandhurst, obtained 104 tons of quartz, from levels of 200 and 360 feet in depth, which gave an average of over 11 ozs. $7\frac{1}{4}$ dwts. of gold to the ton.

From the Hustler's Reef, Sandhurst, the Hustler's Reef Company raised 2,597 tons, which yielded nearly 11 dwts. per ton, and the quartz was broken from levels near the surface down to 410 feet in depth.

The Alabama Company, Heathcote, broke 508 tons, from levels between 360 and 410 feet in depth, which yielded an average of over 18 dwts. per ton.

A crushing of 1,260 tons of quartz, obtained from the New Chum Reef, Tarnagulla, yielded over 15 dwts. to the ton, and was raised from levels as deep as 252 and 336 feet. The reef is from five feet to nine feet in width.

Dannevirke and Company, Hepburn, obtained 258 tons of quartz, from levels between 232 and 355 feet in depth, which yielded $1\frac{1}{4}$ oz. per ton.

At Pleasant Creek, Lamont and Company crushed 3,657 tons, broken from levels between 285 feet and 460 feet in depth, which yielded an average of 15 dwts. per ton. Another crushing, obtained from levels between 280 and 460 feet in depth, of 1,297 tons, yielded 1 oz. per ton.

From the Cross and Scotchman's Reefs, Pleasant Creek, Lamont and Company raised 2,186 tons, from levels between 300 feet and 560 feet in depth, which yielded, when crushed, nearly 1 oz. 17 dwts. per ton; and 2,717 tons from levels between 300 feet and 600 feet in depth, yielded nearly 1 oz. per ton.

At Maldon, the Linscott's Company crushed 690 tons of quartz, taken from levels between 290 and 320 feet in depth, which yielded 795 ozs. 1 dwt. 6 grs., or an average of over 1 oz. 3 dwts. per ton.

From levels between 285 and 350 feet in depth, the St. George Company, Pleasant Creek, raised 1,018 tons, which yielded 1,007 ozs. 15 dwts., or very nearly 1 oz. per ton.

The Wimmera Company, Pleasant Creek, raised 1,800 tons, from levels between 220 and 315 feet in depth, which yielded an average of over $14\frac{1}{2}$ dwts. per ton.

FROM 200 FEET TO 300 FEET.

The Majestic Company, Black Hill, Ballarat, raised 2,291 tons, from levels 200 feet in depth, which yielded over 6 dwts. per ton; and 1,920 tons from 240 feet, which averaged over 8 dwts. per ton. Other crushings from this company's mine, amounting to 4,144 tons, raised from levels between 200 and 260 feet in depth, yielded an average per ton of over 6 dwts.

The Llanberris Company, Ballarat, crushed 6,102 tons, broken from levels between 200 and 300 feet in depth, which yielded an average of over $3\frac{1}{2}$ dwts. per ton.

The Cornish United Company, Ballarat, crushed 1,000 tons, from the 200 feet level, which averaged over 4 dwts. to the ton.

Parcels of 2,073 tons, and 2,112 tons of quartz, broken from levels at 260 feet in depth in the Standard Company's mine, Buninyong, yielded respectively very nearly 7 dwts. and 6 dwts. per ton.

The Erin-go-Bragh Company, Buninyong, crushed 1,600 tons of quartz, raised from levels 240 feet in depth, which yielded nearly $4\frac{1}{2}$ dwts. per ton.

The Britannia Reef, at Carngham, has yielded a large amount of gold. At the 250 feet level the stone averaged about 7 dwts. per ton.

During the first three quarters of 1864 the Port Phillip Company, Clunes, crushed upwards of 30,000 tons, obtained from levels between 230 and 300 feet in depth, which averaged nearly 7 dwts. per ton.

The Yankee Company, Clunes, in 1860, crushed about 120 tons weekly, obtained from levels as deep as 230 feet, which yielded at the rate of $1\frac{1}{2}$ oz. per ton.

The New North Clunes Company, Clunes, crushed 162 tons of quartz, which yielded an average of $9\frac{1}{2}$ dwts. per ton. The parcel was raised from levels between 235 and 250 feet in depth. The same company raised 2,136 tons, from the 240 feet level, which yielded over 5 dwts. to the ton.

The Egerton Company, at Gordon, raised 3,116 tons of vein-stuff, from the 200 feet level, which yielded 7 dwts. 21·64 grs. per ton.

At Steiglitz, the Forty-foot Company raised 150 tons, from levels 280 feet in depth, which yielded over 5 dwts. 17 grs. per ton. The Redan Company obtained 55 tons of quartz, from levels 200 feet in depth, which averaged over 1 oz. $17\frac{1}{2}$ dwts. per ton.

From levels between 200 and 250 feet in depth the Working Miners Company, at Steiglitz, raised 324 tons of quartz, which produced over 6 dwts. of gold per ton.

The new lode in the Steiglitz Company's mine, Steiglitz, yielded 251 tons of quartz, from the 220 feet level, which produced 325 ozs. 6 dwts. of gold, or an average of over $1\frac{1}{4}$ oz. to the ton; and from levels of 240 feet in depth 120 tons, which gave nearly $3\frac{1}{2}$ ozs. to the ton.

At Steiglitz, the New Alliance Company raised 100 tons, from levels of 220 feet, which gave a yield of nearly 8 dwts. to the ton.

The Malakhoff Company, Steiglitz, raised 412 tons, from levels between 210 and 270 feet in depth, which gave an average of nearly 8 dwts. per ton.

From levels as deep as 260 feet the Steiglitz Company crushed 540 tons of quartz, which yielded an average of $1\frac{1}{4}$ oz. to the ton. The same company, at Steiglitz, crushed 235 tons of quartz, which gave over 8 dwts. to the ton; the stone was got from the 220 feet level.

The Follow-the-Leader Company, Steiglitz, crushed a parcel of 30 tons, from levels 200 feet in depth, which averaged 18 dwts.

From the Excelsior Reef, Beechworth, Henderson and Company obtained 183 tons, from the 280 feet level, which yielded 2 ozs. 12 dwts. per ton.

From 2,000 tons of quartz, broken at levels of 240 feet in depth, the Homeward-bound Company, at Yackandandah, had a yield of nearly 10 dwts. per ton.

The Danish Company, Yackandandah, from 20 tons, had an average of 1 oz. 8 dwts., from quartz won at 200 feet in depth.

The United Consols Company, Indigo, from levels between 200 and 230 feet in depth, raised 50 tons of quartz, which yielded 5 dwts. to the ton.

At Buckland, the Australasia Company raised 45 tons, from levels 200 feet in depth, which gave an average of 13 dwts. per ton.

Gregory and Company, Buckland, broke 30 tons, from 210 feet in depth, which averaged 1 oz. 10 dwts. to the ton.

Bow and Company, Buckland, got, from levels 200 feet in depth, in the Rose, Thistle, and Shamrock Claim, a parcel of 800 tons of stone, which gave an average of over $1\frac{1}{4}$ oz. per ton.

The Hunt's Company, Gaffney's Creek, raised, from the 200 feet level, 355 tons, which yielded over $\frac{1}{2}$ oz. to the ton.

From the Homeward-bound Reef, the Golden Belt Company crushed 140 tons of vein-stuff, which were got from the 200 feet level, and yielded 3 dwts. 3 grs. per ton.

At Big River, the Hope-on-Hope-ever Company crushed 229 tons, which yielded an average of over 1 oz. 7 dwts., and the stone was procured from levels 220 feet in depth.

The Tyson's Reef, at Sandhurst, has yielded a large amount of gold. One lot of stone, from a depth of 200 feet, yielded 1 oz. per ton.

The Catherine Reef (U.C.G.M.) Company, Sandhurst, raised 5,594 tons of quartz, from the 280 feet level, which gave nearly 4 dwts. to the ton.

The New Chum Reef, Sandhurst, yielded 2,005 tons, from the 270 feet level, which produced over 17 dwts. per ton; and 1,497 tons, which averaged over 12 dwts. to the ton; and, from levels of 200 and 283 feet in depth, 290 tons of quartz gave an average yield of nearly 1 oz. to the ton.

Twenty-three tons got from levels at 200 feet in depth on the Catherine Reef, Sandhurst, yielded nearly 15 ozs. to the ton.

The Welcome Company, Kilmore, raised 74 tons of quartz, from the 240 feet level, which yielded over 14 dwts. per ton. From levels as deep as 226 feet this company crushed 19 tons and 45 tons of quartz, which yielded respectively 2 ozs. and $13\frac{1}{2}$ dwts. of gold to the ton; and, from the 200 feet level, 40 tons were raised, which gave $1\frac{1}{2}$ oz. to the ton.

The Costerfield Gold and Antimony Company, Heathcote, raised 599 tons from levels between 220 feet and 260 feet in depth, and 849 tons from 260 feet in depth, which yielded respectively nearly 11 dwts. and over 14 dwts. per ton.

Twenty-four tons of quartz, broken from the Long Gully Reef, Heathcote, at a depth of 280 feet, yielded an average of over $8\frac{1}{2}$ ozs. per ton.

The Albert Reef, at Whroo, was two feet thick at 245 feet in depth. The gold was uniformly diffused throughout the stone, and averaged about 12 ozs. to the ton.

Semmens and Company, Mongolian Reef, Waranga, crushed two parcels of stone, from levels as deep as 200 feet; one parcel of 4 tons yielded 17 ozs. to the ton, and the other of 11 tons gave $4\frac{1}{2}$ ozs. to the ton.

At Rushworth, the Pioneer Company crushed 610 tons, got from levels between 200 and 250 feet in depth, which yielded very nearly $\frac{3}{4}$ oz. to the ton; and 330 tons, broken from levels 250 to 300 feet in depth, yielded nearly $1\frac{1}{4}$ oz. per ton.

Anglade and Company, at Whroo, obtained 9 tons, from levels 200 feet in depth, which gave $3\frac{1}{2}$ ozs. per ton.

Lewis and Menzies, Whroo, raised 3,258 tons of quartz, from levels between 220 and 280 feet in depth, which yielded over 12 dwts. per ton.

The Mining Registrar for the Waranga North Subdivision, in his report for the quarter ending 31st March, 1867, referring to two mining companies, states:—"The works of these two companies are well managed, and the fortunate proprietors find, as their mining operations increase in depth, that the quartz improves in quality. At Balaclava a new engine-shaft was commenced to be sunk last week. It is laid out so as to strike the reef at from 450 to 500 feet deep."

Ratcliff and Company, Rushworth, raised from the London Reef 46 tons of quartz, from the 300 feet level, which gave an average yield of over 3 ozs. 3 dwts. of gold per ton.

From levels between 200 and 250 feet in depth, the Frederick the Great Company, Raywood, crushed 1,210 tons, which yielded very nearly $15\frac{1}{2}$ dwts. per ton.

A yield of over 3 ozs. 3 dwts. per ton was obtained from 290 tons of quartz. The quartz was raised from levels 280 feet in depth, in the Cambrian Company's mine, at Dunolly.

From between levels of 220 and 260 feet in depth 1,080 tons of quartz were raised from the Sandstone Reef, Tarnagulla, which gave an average of over 11 dwts. to the ton.

The reef named "Poverty," at Tarnagulla, has proved to be one of the richest in the colony. At 200 feet in depth it yielded 600 ozs. of gold weekly. At 300 feet, in claim No. 5 North, the reef was six feet in thickness, and averaged from 6 to 7 ozs. per ton.

The following extracts are taken from the mining surveyor's report on the Dunolly and Tarnagulla Divisions, for the quarter ending 30th June, 1868 :—

"Sandstone Reef.—South Sandstone Company have 70 tons of quartz on the surface, which they anticipate will yield $1\frac{1}{2}$ oz. of gold per ton, and their prospects are improving, the stone in the water looking better than ever—reef six feet thick. In the prospecting claim, the reef at the 260 feet level is eight feet thick, the average yield from three feet of which is $1\frac{1}{2}$ oz., and the remainder $\frac{1}{2}$ oz. per ton. The Victoria Company, next north, are raising stone from the 260 feet level—reef from three to five feet thick—which is expected to yield 15 dwts. per ton. They are erecting powerful pumping and winding machinery. The next claim north are sinking for the same run of stone worked by the Victoria Company.

"New Chum Reef.—Cambrian Company.—The water shaft is down about 328 feet, from which they are raising stone taken from the 312 feet level, where the reef is nine feet thick : their prospects continue as good as ever. They have 170 loads of stone now on the surface, and are raising, on an average, 90 loads per week. Prince of Wales Company, next north, have their shaft down 279 feet. A cross-cut has been put in at 248 feet ; and on the 29th June they cut the reef, with gold visible in every stone, which has very much enhanced the value of the shares. No. 4 South are taking out stone at the twenty-two feet level, which is payable four feet thick. Nos. 1, 2, and 3 South (amalgamated) struck stone in the main shaft at 256 feet level. Gold is visible, but none has yet been crushed."

From the March Reef, Inglewood, 1,375 tons of quartz were obtained, from the 200 feet level, which yielded nearly $8\frac{1}{2}$ dwts. of gold per ton.

The Duke of Edinburgh Company, Redbank, got over 13 dwts. of gold per ton, from 60 tons of quartz raised from the 260 feet level.

The Chrysolite Reef, at St. Arnaud, yielded 371 tons, from the 280 feet level, which produced an average of $\frac{1}{2}$ oz. per ton ; and $48\frac{1}{2}$ tons, from the 210 feet level, gave 1 oz. $2\frac{1}{2}$ dwts. per ton.

The Rising Star Company, St. Arnaud, raised 120 tons, from levels as deep as 240 feet, which yielded over $2\frac{3}{4}$ ozs. per ton ; and, from the 200 feet level, 129 tons 10 cwt., which gave over $18\frac{1}{2}$ dwts. of gold to the ton.

The Wilson's Hill, Company, St. Arnaud, crushed 71 tons of quartz, raised from levels of 235 feet in depth, which yielded over 1 oz. per ton.

The Ballarat Reef, St. Arnaud, yielded 5 tons of quartz, from the 240 feet level, which gave over 12 dwts. per ton.

The Bolivia Reef, at Castlemaine, at 200 feet in depth, averaged over 1 oz. to the ton. One crushing of 140 tons averaged $5\frac{1}{2}$ ozs.

The Ajax Company, Castlemaine, raised 69 tons of quartz, from the 270 feet level, which gave an average yield of very nearly 2 ozs. 2 dwts. to the ton; and, from the 240 feet level, 241 tons of quartz have been crushed, which yielded nearly 10 dwts. of gold to the ton.

One hundred and fifty tons of quartz, broken from levels of 200 feet in depth, on the Ajax Reef, Hepburn, produced 8 dwts. of gold per ton. Another crushing of 400 tons, from the 240 feet level, yielded 7 dwts. per ton.

From 225 feet in depth, the Specimen Hill Company raised 1,673 tons of quartz, which gave an average of over 6 dwts. to the ton.

At Hepburn, the Crown Company crushed 994 tons, obtained at levels 270 feet in depth, and 1,162 tons, from levels 240 feet in depth, which yielded respectively nearly 16 dwts. and 10 dwts. per ton.

The Cornish Company, Hepburn, from 2,000 tons, got from levels of 260 feet in depth, and 1,600 tons, from levels of 265 feet, obtained over 8 dwts. and $8\frac{1}{2}$ dwts. of gold per ton.

The Wellington Company, Maldon, crushed 278 tons of quartz, from the 200 feet level, which yielded over 1 oz. per ton. And from levels between 240 and 260 feet in depth, 302 tons of quartz were crushed, which gave more than $9\frac{1}{2}$ dwts. per ton.

The Union Company, Maldon, from 1,260 tons, obtained at 280 feet in depth, had a yield of very nearly 3 ozs. 18 dwts. per ton.

At Maldon, 660 tons of quartz were raised, from levels as deep as 290 feet, on the Beehive Reef, which yielded over $1\frac{1}{4}$ oz. per ton; and 284 tons, from 200 feet, yielded over $\frac{1}{2}$ oz. to the ton.

From 1,921 tons, obtained from levels between 220 and 280 feet in depth, the Great Western Company, Maldon, gained over $11\frac{1}{2}$ dwts. per ton.

An average of nearly $18\frac{1}{4}$ dwts. was got from 994 tons, raised from levels 260 feet in depth, in the Eaglehawk Company's mine, Maldon.

The Linscott Company, Maldon, obtained a yield of over 19 dwts. from 1,300 tons, broken from levels at 280 feet in depth.

The Nuggety Company, Maldon, crushed 606 tons of quartz, from levels 240 feet in depth, which yielded very nearly $8\frac{1}{2}$ dwts. per ton.

From 81 tons, won at 230 feet, the Albert Company, Maldon, obtained nearly $8\frac{1}{4}$ dwts. per ton.

The Alpha Company, Maldon, gained nearly 2 ozs. 6 dwts. per ton from 310 tons, obtained from levels 290 feet in depth.

The Bell's Reef Company, Maldon, raised 258 tons of quartz, from levels between 200 and 250 feet in depth, which averaged nearly 1 oz. 9 dwts. per ton.

Two lots of stone from Fenteman's and Perkin's Reefs, Tarrangower, each of 6 tons, yielded respectively an average of 1 oz. 10 dwts. and 3 ozs. per ton. The quartz was got from the 240 feet level.

At Muckleford, the Union Company raised 576 tons, from levels 280 feet in depth, which yielded over 12 dwts. 21 grs. per ton.

The Eaglehawk Association, Maldon, raised 603 tons, from 250 feet, which averaged very nearly 2 ozs. per ton; 679 tons, from 230 feet, which yielded over 4 ozs.

per ton; 638 tons, from 260 feet, which averaged over 1 oz. per ton; and 981 tons of quartz, from levels 270 feet in depth, which yielded over 16 dwts. to the ton.

Nearly 5 dwts. of gold to the ton were extracted from 746 tons of quartz, broken from the 300 feet level on the Fenteman's Reef, Maldon.

The Nelson Company, at Maldon, raised 620 tons of quartz, from the 270 feet level, which gave over 3 ozs. 7 dwts. of gold to the ton.

From Oram's Reef, Panton Hill, crushings amounting to 121 tons of quartz, obtained from levels between 200 feet and 220 feet in depth, yielded over 2 ozs. 9 dwts. per ton. Other crushings, got from 250 and 260 feet in depth, and amounting to 71 tons, yielded more than 2 ozs. per ton; and 20 tons 10 cwt., raised from levels as deep as 226 feet, yielded very nearly 11 dwts. to the ton.

The New Amelia Reef Company, Blue Mountain, crushed 150 tons, raised from the 245 feet level, which gave 12 dwts. to the ton.

At Blue Mountain, the Alma Reef Company raised 492 tons, from levels as deep as 220 feet in depth, which yielded very nearly $4\frac{1}{2}$ dwts. per ton.

At Ararat, the North Star Company crushed 824 tons, which were won at 230 feet in depth, and the yield was 1 oz. $1\frac{1}{2}$ dwt. per ton; and 1,570 tons, from levels 204 feet in depth, gave more than 9 dwts. 17 grs. per ton. From levels of 296 feet in depth 1,082 tons of quartz were obtained, which gave nearly 14 dwts. to the ton, and 1,181 tons, which yielded $8\frac{1}{2}$ dwts. per ton; another crushing of 1,626 tons from the same level yielded 12 dwts. to the ton.

The Extended North Star Company, Ararat, from 296 feet in depth, obtained 965 tons, which averaged over $17\frac{1}{2}$ dwts. per ton.

The Kangaroo Company, Ararat, from levels between 200 and 300 feet in depth, extracted 1,932 tons, which averaged 15 dwts.

The Extended South Star Company, Ararat, from levels of 270 feet in depth, raised 700 tons of quartz, which yielded 13 dwts. per ton.

At Pleasant Creek, the Victoria Company raised, from between 250 and 300 feet in depth, 950 tons of quartz, which yielded over 1 oz. 2 dwts.; and from levels between 280 feet and 300 feet 400 tons of quartz, which yielded 15 dwts. per ton.

The St. George's Company, Pleasant Creek, crushed 838 tons of quartz, obtained from levels 290 feet in depth, which averaged over $17\frac{1}{2}$ dwts. per ton; and from 285 feet 650 tons of quartz, which yielded 1 oz. 15 dwts. per ton.

At the 200 feet level the Pleasant Creek Company, at Pleasant Creek, crushed 722 tons, which gave an average per ton of over 7 dwts. 23 grs. per ton.

The Rose of Denmark Company, Pleasant Creek, raised, from levels 270 feet, 1,120 tons, which averaged 10 dwts. per ton.

The Mining Registrar for the Pleasant Creek Division makes the following remarks in his report for the quarter ending 31st December, 1866:—

"In quartz mining I have to report a continued and steady improvement. The result of the last twelve months' work has completely restored confidence in the permanence and richness of the various deep reefs, another of which has been discovered during the quarter. This occurred in claim No. 4 North, Scotchman's Reef, at a depth of 319 feet from the surface, being about fifty feet below the water-level. The reef is eight feet in thickness, and is almost flat, its inclination from the horizontal being not more than one foot in eight. Yield about 2 ozs. to the ton.

"In consequence of the success hitherto attending the various ventures in deep sinking, several spirited enterprises have been taken in hand, the most important of which is the sinking of a new shaft on the North Cross Reef Company's lease, with

the object of striking the cross-reef at a depth of 600 feet from the surface. Next in order is the sinking of Lamont, Grant, and Company's shaft, on the same reef, to a depth of 560 feet, with a drive of 100 feet to the same reef.

"I may state with great confidence, that the prospects of quartz mining are most encouraging. The experience of the last quarter has contributed much to dispel any doubts that may have existed as to the permanence or richness of the reefs in the deepest workings, and a prosperous future may be anticipated for those miners who have persevered through former seasons of depression and uncertainty. * * *

"A new reef has been struck in the extreme northern claim, on the Perthshire Reef, at a depth of about 200 feet; the trial kiln yielded 1 oz. 2 dwts. per ton. This reef has been broken into for a distance of seven feet across its course without getting through it, so that it must be of considerable thickness; in consequence of this discovery, shares have advanced considerably in value along the whole Perthshire Reef."*

At Donnelly's Creek, the Crinoline Company raised, from levels 225 feet in depth, 1,171 tons, which averaged nearly 17 dwts.; from levels of 230 feet in depth 1,179 tons, which averaged more than 18 dwts. per ton; and from the 300 feet level 210 tons, which yielded 18 dwts. to the ton.

FROM 600 FEET AND DEEPER.

The Victoria Company, at Clunes, raised 5,129 tons of quartz from levels as deep as 720 feet, which yielded nearly 7 dwts. of gold to the ton. The Mining Registrar for the Creswick Division makes the following remarks relative to the above company, in his report for the quarter ending 31st December, 1868:—

"In the Victoria Company's claim, the eastern cross-cut on the No. 8 (or 700 feet) level has been driven eighteen feet, and intersected Robinson's Reef, at a total distance of 158 feet from the shaft. On the lode fifty-two feet south and forty-six feet north have been driven, and the stone looks well. The New North Clunes Company's lode has been intersected at the 330 feet level, and looks well. About ninety men are employed on the mine."

FROM 500 TO 600 FEET.

At Little Bendigo, Ballaarat, the Temperance Company raised 1,000 tons of quartz, from levels as deep as 500 and 650 feet, which yielded over 9 dwts. of gold to the ton.

The Albion Company, at Steiglitz, crushed 2,163 tons of quartz, which were obtained from levels as deep as 573 feet, and yielded nearly 13½ dwts. per ton. The Mining Registrar for the Steiglitz Subdivision, in his report for the quarter ending 31st December, 1868, says:—

"The Albion Company, Portuguese Reef.—This claim as it is worked deeper is better defined, wider, and presents every appearance of giving higher returns. At the 600 feet level the reef averages three feet six inches in thickness; and I inspected one block of quartz from that level of about 1 cwt., which if crushed separately must have yielded at least 6 ozs. of gold."

At Ararat, the Southern Cross Company raised 1,502 tons of quartz, from levels as deep as 510 feet, which yielded over 9½ dwts. to the ton.

The Kangaroo Company, at Ararat, raised 917 tons of vein stuff, from levels 500 feet in depth, which gave an average yield of over 13 dwts. of gold to the ton.

* *Mining Registrar's Report*, quarter ending 30th June, 1868, p. 37.

The following table contains a few not unimportant facts relative to the character of the veins in the deepest shafts which have been sunk in the colony:—

TABLE SHOWING THE DEPTHS OF THE DEEPEST SHAFTS WHICH HAVE BEEN SUNK ON VEINS IN THE SEVERAL DIVISIONS OF THE COLONY, WITH REMARKS AS TO THE THICKNESS OF THE VEINS, THE YIELD, ETC.—AUGUST, 1868.

District and Division.	Name of Company.	Name of Reef.	Depth of Deepest Shaft.	Width of Reef at			Average Yield of Gold per ton.	Dip of Reef.	
				Surface.	Intermediate Depths.	Bottom.			
			feet.	ft. in.	ft. in.	ft. in.	oz. dt. gr.		
BALLARAT:—									
Central Division	Temperance (a) -	Band of Hope	650	0 8	1 0	1 9	0 10 18	W.	45°
Southern Division	Comet -	Staffordshire	270	3 0	9 6	11 0	0 2 4	..	1 ft. in 12 ft.
Buninyong Division	Imperial -	Hiscock's	332	25 0	25 0	25 0	0 4 19	E.	30°
Smythesdale	Britannia (b) -	Britannia	500	5 0	8 0	10 0	0 4 15	S.	1 ft. in 2 ft.
Creswick	Victoria (c) -	Robinson's	713	..	..	9 0	0 10 0	E.	1 ft. in 1 ft. 5 in.
Gordon	Egerton -	Mount Egerton	350	50 0	30 0	20 0	0 7 21	W.	3 ft. in 10 ft.
Steiglitz	Albion (d) -	Portuguese	573	0 7	1 0	1 0	0 12 6	E.	3½ in. in 1 ft.
Blackwood	Williams Bros. and Co.	Simmons'	266	12 0	6 0	6 0	0 8 12	W.	1 ft. in 3 ft. 6 in.
Blue Mountain, South	(e) -	-	60	..	..	..	..	..	..
BRECKENRIDGE:—									
Breckworth	Henderson and Co.	Excelsior	300	1 0	3 6	1 6	4 0 0	..	1 ft. in 10 ft.
Stanley	Homeward Bound	Homeward Bound	430	2 0	2 0	2 0	0 13 19	N.	1 ft. in 3 ft.
Yackandandah	Homeward Bound (f)	Homeward Bound	148	3 6	7 6	8 0	0 7 12	W.	1 ft. in 3 ft.
Sandy Creek	(g) -	-	..	..	..	..	..	..	..
Indigo	United Consols (h)	Higgin's Reef	250	2 3	7 0	0 11	0 5 0	W.	70°
Buckland	McLean, Wallace, and Co.	Rose, Thistle and Shamrock	536	4 6	3 0	1 6	0 9 0	S.	2 ft. in 5 ft.
Jamieson, North	Ajax (i) -	Lucky Reef	230	1 9	0 11	0 4	..	W.	30°
Gaffney's Creek	Hunt's (j) -	Homeward Bound	400	120 0	60 0	60 0	0 10 0	E. & W.	1 ft. in 10 ft.
Wood's Point	Alps Great Central	Morning Star	363	..	..	0 11	0 1 18	N.E.	30°
Big River	Hope On Hope Ever	Seek and Find	320	2 0	2 3	2 6	1 7 0	E.	1 ft. in 3 ft.
Mitta-Mitta	-	-	..	..	..	..	..	..	..
Jamieson, South	Venture (k) -	Star of the West	300	3 0	3 6	..	1 15 0	W.	1 ft. in 20 ft.
SANDHURST:—									
Sandhurst	Hustler's Reef (l) -	Hustler's	600	12 0	1 7	1 7	2 0 0	E.	1 ft. in 3 ft.
Kilmore	Welcome (m) -	Welcome	296	..	1 3	1 4	1 6 16	..	1 ft. in 6 ft.
Heathcote and Waranga, South	Alabama -	Caledonia	430	1 0	1 0	1 0	1 5 0	E.	45°
Waranga, North	Lewis and Menzies (n)	Balaclava	311	5 0	5 0	5 0	0 12 0	W.	68° 40'
Raywood	Nil Desperandum (o) -	Weibourne	181	..	8 0	10 0	0 8 14	N.E.	1 ft. in 6 ft.

(a) This mine was formerly worked by the Sisters Company.—(b) Water-level 100 feet in depth.—(c) The cap of the reef was found at a depth of 330 feet from the surface.—(d) The width of this reef between walls averages four feet, but the solid quartz is only from ten inches to one foot in thickness. The whole of the vein-stuff is crushed.—(e) Abandoned shaft.—(f) This relates to quartz taken from the deepest shaft; but there are levels driven from tunnels intersecting veins at much lower depths.—(g) There are no quartz reefs worked at present in this subdivision.—(h) Another shaft, which has been abandoned for more than six years, is said to be 300 feet in depth.—(i) Mr. William Clarke, of Melbourne, reports the strike of this reef to be N.N.W.; the highest yield of gold obtained from it to be 65 ozs. per ton (the width of the quartz being from two to three inches).—(j) At 400 feet in depth, the eastern wall of the reef has not yet been struck. From the surface to 100 feet in depth, the reef dips to the west; from 100 to 150 feet in depth, it dips to the east; and from 150 to 400 feet in depth, this reef is nearly perpendicular. The reef obtains its greatest width in this claim.—(k) At the lower depths only a portion of the lode has been worked.—(l) A cross-cut is now driving to cut the reef at 600 feet in depth.—(m) It is the confident opinion of the shareholders in this company that the yield of gold will improve as the depth below the water-level increases.—(n) Thin quartz veins penetrate the sandstone on the western side of the reef. A width of more than 100 feet of this network of quartz veins, from the surface to a depth of ninety feet, has been crushed.—(o) A cross-cut is now driving to cut the reef at 181 feet in depth. This reef was first met with at fifty feet in depth.

TABLE SHOWING THE DEPTHS OF THE DEEPEST SHAFTS, ETC.—*continued.*

District and Division.	Name of Company.	Name of Reef.	Depth of Deepest Shaft.	Width of Reef at			Average Yield of Gold per ton.	Dip of Reef.
				Surface.	Intermediate Depths.	Bottom.		
			feet.	ft. in.	ft. in.	ft. in.	oz. dt. gr.	
MARYBOROUGH:—								
Maryborough -	Mariner's Reef -	Mariner's -	650	1 0	0 11	5 0	0 6 0	.. 1 ft. in 2 ft. 6 in.
Amhorst -	(a) -	White Horse -	268	3 0	..	2 3	0 10 0	W. 1 ft. in 10 ft.
Avoca -	(b) -	Vale's -	235	1 0	1 0	1 0	..	W. 78°
Dunolly and Tarnagulla -	Victor's -	Poverty -	540	7 0	13 0	6 0	1 0 0	W. 1 ft. in 6 ft.
Korong -	Havilah (c) -	Maxwell's -	330	..	0 9	5 0	..	E. 10°
Redbank and St. Arnaud, South -	Duke of Edinburgh -	Pyrenees -	285	3 0	0 4	0 9	0 13 8	W. 58°
St. Arnaud, North -	Brown and Hoaking (d) -	Wilson's Hill -	320	12 6	15 0	17 6	1 10 0	.. 1 ft. in 5 ft.
CASTLEMAINE:—								
Castlemaine -	Harris and Co. -	Eureka -	280	12 0	11 0	6 0	0 5 0	W. ..
Fryer's Creek -	Heath and Co. -	Bullock -	175	0 9	2 0	2 0	0 2 0	E. 45°
Hepburn -	Duke of Edinburgh -	Crown -	360	..	9 0	9 0	..	W. 2 ft. 6 in. in 6 ft.
Taradale -	Achilles Extended -	Achilles -	260	18 0	..	21 0	0 2 13	.. 45°
Maldon -	Cymru (e) -	Beehive -	470	8 0	15 0	15 0	..	W. 1 ft. 8 in. in 6 ft.
St. Andrew's -	Diamond Creek -	Diamond Creek -	250	1 6	1 6	1 6	1 10 0	E. 45°
Kyneton -	Prince Alfred -	Kangaroo -	280	16 0	2 6	1 3	0 1 12	.. 15°
Blue Mountain, North -	New Amelia Reef -	Amelia -	255	1 6	4 0	2 6	0 12 0	.. 1 ft. in 10 ft.
ARARAT:—								
Ararat -	Kangaroo (f) -	Campbell's -	519	1 10	1 10	1 10	0 8 0	E. 1 ft. in 10 ft.
Pleasant Creek -	Grant, Lamont & Co. (g) -	North Cross -	562	..	6 0	6 0	1 1 5	S.W. ..
Barkly -	(h) -	Glendhu -	235	3 6	..	1 6	..	W. ..
Raglan -	Sheet Anchor (i) -	Sheet Anchor -	60	..	..	6 0	0 7 12	W. ..
GIPPSLAND:—								
Omeo -	Eureka -	-	75	1 0	1 0	1 1	1 0 15	W. 20°
Mitchell River -	Trio -	Trio -	151	4 0	4 0	2 6	1 4 11	.. 71° 30'
Crooked River -	Good Hope -	Good Hope -	471	0 10	0 9	0 8	2 3 0	N.E. 13 in. in 6 ft.
Jericho -	Blue Jacket -	Blue Jacket -	194	1 2	1 2	1 2	0 7 15	N.E. 25°
Donnelly's Creek -	Walhalla (j) -	-	170	..	..	1 3	..	.. 53° 30'
Stringer's Creek -	Wealth of Nations -	Shamrock -	110	0 6	..	2 6	1 15 21	W. 1 ft. in 30 ft.
Russell's Creek -	Gulding Star -	Gulding Star -	135	1 6	2 9	..	..	W. 1 ft. in 6 ft.
South Tarraville -	(k) -	-	..	..	..	..	..	

(a) Abandoned claim.—(b) Abandoned shaft.—(c) No work has been done in connection with this shaft during the past three years.—(d) On the west side of this reef there is a large body of white quartz, which was thirty feet in thickness at the surface, ninety feet in thickness at 200 feet in depth, and eighty feet in thickness at 300 feet in depth.—(e) Prospects of gold have been got in the dish, from vein-stuff broken at 470 feet in depth.—(f) This reef is perpendicular for 300 feet from the surface; and thence the underlie is to the east.—(g) This reef did not outcrop on the surface in this claim.—(h) The shaft is abandoned. The vein-stuff in this reef contained a large proportion of silver.—(i) Prospecting shaft.—(j) The width of this reef varies from a thread to twelve feet.—(k) There are no quartz reefs worked at present in this subdivision.

NOTE.

Mr. William Nicholas has made a brief summary of the results here given:—As to the width of the reefs: where the width is stated in the three columns, there are thirteen reefs which increase in width from the surface to the lowest level of the workings, and thirteen reefs which decrease. Of those cases in which the width of the reef is given in the column headed "At bottom" and in only one of the other columns, there are five reefs which increase and two reefs which decrease. In ten cases there is no difference in the width. Thus there are eighteen reefs which get wider with the increase in depth, ten in which there is no change, and fifteen which become narrower as the depth increases. In other words, two-thirds of the forty-three reefs either increase in width or continue to have the same thickness downwards. There are four reefs named in the table not included in these notes, because the width is given for the bottom levels only.

The fact that the deeper shafts in the colony are being sunk still deeper, and that large sums are invested in mines where deep sinking only will admit of vein-stuff being got within the limits of the claims where they are situate, should satisfy the inquirer that those most interested in vein-mining, and best acquainted with it, have full confidence in the safe and profitable character of these enterprizes. In most cases the engine-shafts are so planned as to admit of their being sunk to 1,000 feet at the least, without necessitating any very important alterations. They are usually of large size, and no needful expense is spared in fitting them.

The following list gives some information respecting the progress of the larger works:—

PARTICULARS RESPECTING SOME OF THE DEEPEST SHAFTS IN THE COLONY, WHICH ARE NOW BEING SUNK, OR THE SINKING OF WHICH HAS RECENTLY BEEN STOPPED FOR THE PURPOSE OF PUTTING IN CROSS-CUTS, AND OPENING UP THE REEFS.—AUGUST, 1868.

District and Division.	Name of Company.	Depth of Shaft.	Remarks.
BALLAARAT:—		Feet.	
Creswick - - -	Victoria - - -	713	Shaft still sinking. A cross-cut at 700 feet is now driving.
" - - -	Port Phillip and Colonial Gold Mine	632	Cross-cutting at 591 feet in depth. Mr. Bland reported to this company, that there is no reason to imagine that the quartz reefs will fail to yield in depth.
" - - -	New North Clunes -	600	A cross-cut is driving at 590 feet in depth. A second shaft is now in course of sinking, and is down 586 feet.
Steiglitz - - -	Albion - - -	582	They are working the reef from the 573 feet cross-cut.
SANDHURST:—			
Sandhurst - - -	Hustler's - - -	600	Cross-cuts east and west are now driving at 600 feet in depth, to cut the reefs on each side of the shaft. This shaft is eleven feet by four feet within the timber. The last twenty feet of sinking in the shaft cost about \$28 per foot, and the expense of sinking the shaft, independent of the machinery, is about \$10,000.
" - - -	Comet - - -	544	It is at present proposed to sink to a depth of 600 feet. A cross-cut is driving to cut the reef at 500 feet.
" - - -	Johnson's Reef Gold Mine	527	A cross-cut is driving at 525 feet in depth. It is at present proposed to sink an additional fifty feet, and again cross-cut. This company anticipate sinking to 1,000 feet in depth, at the very least.
" - - -	Collmann and Tacchi's Reef Gold Mine	479	Shaft still sinking.
" - - -	Ellesmere - - -	400	Shaft still sinking.
Waranga, North -	Lewis and Mensie's -	311	It is at present proposed to sink to between 450 and 500 feet. A cross-cut is driving to cut the reef at 311 feet.
CASTLEMARINE:—			
Maldon - - -	Cymru - - -	470	It is at present proposed to sink to 500 feet. Shaft sinking.
" - - -	Beehive - - -	447	It is at present proposed to sink to a depth of 480 feet. Shaft sinking.
ARARAT:—			
Ararat - - -	Southern Cross - -	510	They have just completed the sinking of the shaft an additional 100 feet.
Pleasant Creek -	Rose of Denmark - -	—	It is at present proposed to sink to a depth of 600 feet. Shaft sinking.
" - - -	Grant, Lamont, and Co.	562	Tenders for boring 400 feet in depth from the bottom of this shaft have been accepted.

When it was proposed to hold in Melbourne an Inter-Colonial Exhibition of Industry and Art, *en rapport* with the Exposition Universelle in Paris, I caused to be collected from the most important quartz reefs of the colony, illustrative (not peculiar) specimens of the vein-stones, in the hope that some useful facts would be derived from an examination of them.

I was careful to impress upon the mining surveyors and mining registrars who collected them the necessity of extreme caution in procuring accurate information as to the depth from the surface at which each specimen was taken, the depth of the water-line, the width of the reef, the average yield of gold per ton, &c.; and there is reason to believe that in all cases where statements accompany the specimens they are authentic.

As soon as the rocks were received they were described and catalogued, and much care was taken in doing this. Loose vague description was avoided, by forming a scale for the guidance of the gentleman entrusted with the preparation of the catalogue. For instance, the words "Pyrites absent," "Proportion of pyrites very small," "small," "large," "very large," had a meaning as definite as could be well made by an inspection of the exterior; and the work was closely superintended and checked by myself.

Mr. William Nicholas, who had carefully examined and handled all the specimens, informed me that some useful facts could be eliminated by classifying them, and I encouraged him in this work, which has resulted in the following statement. It is useful and suggestive, and serves to correct some opinions formed on rough data, collected here and there by persons who have not had an opportunity of examining many lines of reefs in dissimilar localities.

In all 279 specimens were exhibited, but not all of them were available for purposes of comparison. Mr. Nicholas's report is as follows :—

"The following results have been obtained by tabulating the information relating to a large number of the specimens exhibited in the late Inter-Colonial Exhibition, by the Mining Department.

"The facts relating to pieces of quartz taken from points above the water-level have been kept distinct from the facts relating to those raised from beneath it; and thus two tables have been formed. The first contains particulars of fifty-six, and the second of fifty-two specimens.

"In the catalogue it sometimes occurs that there are specimens from different claims or mines situated on the same line of reef. Where this has been the case the whole of the information relating to such specimens has been collected, and the averages taken, and such information placed in the table to which it belongs.

"Out of the 108 specimens in the tables, 100 represent distinct quartz reefs, and the remaining eight are from four reefs which have each a specimen in both tables.

"The following are the results arrived at. In considering them it should be noted that the average depth from which the fifty-six specimens were taken (above the water-level) is 84 feet 10·85 inches, and of the fifty-two (beneath it) 252 feet 11·05 inches; and that the average depth of the water-level in the first table is 161 feet 8·08 inches, and in the second table 119 feet 7·04 inches. The water-level was given in forty-six instances in the former table, and forty-nine in the latter* :—

"1st. The average yield of gold per ton obtained from quartz (of which these specimens were samples) taken from above the water-level is 1 oz. 9 dwts.

* The general average of the ninety-five cases in which the water-level was given is 139 feet 10·62 inches; the thirteen for which the water-level is not given, were either from so shallow or so great depths that there could be no doubt of their being taken from above or below the water-level.

2.67 grains, and from beneath it 1 oz. 13 dwts. 15.68 grs., or an increased richness in the latter case of over $4\frac{1}{2}$ dwts. The yield was given in fifty-three instances in table No. 1, and fifty in table No. 2.

"2nd. The average width of the reefs above the water-level is 4 feet 6.63 inches, and beneath it 10 feet 5 inches, or an increase of more than twice in width.

"3rd. The proportion of pyrites contained in each specimen is as follows:—

	Table No. 1.	Table No. 2.
Absent - - - - -	31	5
Scarcely any - - - - -	12	14
Very small - - - - -	8	11
Small - - - - -	3	13
Not large - - - - -	1	4
Large - - - - -	1	5
	56	52

"This confirms the statement that there is a much larger quantity of iron pyrites below the water-level than above it.*

"4th. Galena was found to be present in seven cases in table No. 1, and in twenty-four in table No. 2, showing a large increase of galena below the water-level.

"5th. Peroxyd of iron was present in twenty-four instances in table No. 1, and ten in table No. 2. Twenty-two specimens contained in the first table were more or less stained by peroxyd of iron, and eight in the second table. It was absent in the remaining ten specimens in table No. 1, and thirty-four in table No. 2.*

"The specimens made use of in the tables include all those in the catalogue respecting which the necessary information was available.

"The mining surveyors and registrars who supplied the Mining Department with the quartz specimens described in the catalogue, were asked for average and not peculiar specimens from the more important reefs in their divisions.

"The results have been obtained from specimens taken from the centres of quartz mining in the undermentioned mining districts:—

	Table No. 1.	Table No. 2.
Ballaarat - - - - -	6	14
Sandhurst - - - - -	6	12
Beechworth - - - - -	13	2
Castlemaine - - - - -	10	13
Maryborough - - - - -	14	7
Ararat - - - - -	7	4
	56	52

"Taking the whole of the information and the results obtained from it into consideration, there is much reasonable data produced in support of the theory *that quartz reefs are richer as they increase in depth*, and in addition to this *that they are wider*.

* These results illustrate to what an extent decomposition has taken place in the pyrites above the water-level.

If our reefs generally are wider as they are followed downwards in any like ratio to that obtained by these tables, then they are likely to become more and more valuable; even supposing that the yield of gold per ton should decrease with the depth: but it does not.

"The facts touching the proportion of sulphides found in the veins, together with much close observation of this collection of quartz specimens (probably the largest ever made), corroborate some opinions which I had formed whilst engaged in connection with quartz mining on the Sandhurst Goldfield. I was led to believe that the richest and most permanent, or (as we might call them) *master lodes*, were those which below the water-level contained the largest quantities of sulphides, such as iron pyrites and galena, and which gave clear indications of a laminated structure.

"The richest and most important reefs in the colony are of a laminated structure, and contain a large proportion of pyrites and galena. As the most important I may cite the Eastern, Robinson's, Welcome, and Western Reefs at Clunes; the reef in the Sisters Company's Mine, Little Bendigo; the New and Old Lodes, and the Portuguese Reef, at Steiglitz; the Cross and Scotchman's Reefs, at Pleasant Creek; the Mariner's and Whitehorse Reefs, at Maryborough; the Maxwell's and Poverty Reefs, at Inglewood; the Beehive, Wilson's, Eaglehawk, and Thornhill's Reefs, at Maldon; and the Hustler's, St. Mungo, Nelson's, Bird's, Brown's, and Comet Reefs, at Sandhurst. These reefs have been worked from depths of 200 and 300 feet down to 600 and 650 feet, and the greater portion of the sulphides and much of the gold contained in them are found in the laminae.

"Sample blocks of quartz from all these reefs are in the collection of the Mining Department, and were exhibited in the late Intercolonial Exhibition."

Appendix C contains a list of the principal auriferous reefs of the colony, and the direction of the same in relation to the true meridian.

There are altogether 2,561 reefs which have been opened and more or less wrought, but it is not possible, at present, to give information respecting all of them.

These statements will probably be accepted as a practical refutation of the theory advanced by Sir Roderick Murchison; but if more evidence is wanted, it is to be found in the records of the Mining Department.

The time when the miners quarried the quartz on the surface is long past. Nearly everywhere they get the stone from levels at considerable depths from the surface; and the average yield from large parcels of quartz therefore has a value now which it had not in the early days of gold mining. From returns made by the mining surveyors and mining registrars, it appears that the yield of gold from certain parcels of quartz crushed during a period of ten years (from 1859 to 1868) has averaged 11 dwts. 12·37 grs. per ton on 5,811,669 $\frac{2}{3}$ tons. These figures represent only the "crushings" respecting which the officers of the department have been able to obtain information, and do not show the total quantities of quartz put through the mills; but there is no reason to believe that the average yield would be less if all the millowners had furnished returns.

Touching the third question—the age of the rocks in which gold-bearing veins are likely to occur, and the condition and lithological character of these rocks—we do not find the statements of Sir Roderick Murchison borne out by the facts before us. Both in the lower and upper silurian rocks of this colony, the auriferous veins traverse unaltered rocks, and we do not find anywhere proofs that "the original

position of the metal is in quartzose veinstones that traverse *altered* silurian slates (chiefly lower silurian.)*

It is true that, in Victoria, the veins which have been mostly wrought occur in rocks of silurian or Devonian age, but it is quite possible that they may be found traversing younger strata.

The great metalliferous belt in California is composed of rocks of jurassic and triassic age; and gold occurs there beyond doubt in veins intersecting cretaceous rocks. Mr. Meek and Mr. Gabb have examined and described the fossils found in the auriferous slates of jurassic age. They found a *pecten*, a *nucula* or *leda*, *Lima Erringtoni*, *pholadomya orbiculata*, and *belemnites Pacificus*. Two or three bivalves, which resembled an oblique *inoceramus*, were ultimately found to belong to some species of the genus *aucella*, confined entirely—as far as is known at present—to rocks of jurassic age.

These facts appear to be sufficient of themselves; but some palæontologists suppose that there is room for doubt as to the character of the fossils which have been discovered in California. This may be so, but it is not probable. Professor Whitney, aided by competent assistants, has investigated vast tracts in the gold-bearing regions of the Pacific coast of North America; and well qualified himself, it is not likely that he or his assistants would be misled either as to the position or age of the rocks. And the negative evidence is strong. The *trilobites* and *graptolites* which are so common in our rocks (together with other well marked silurian fossils, as, for instance, the *cornulites*, *tentaculites*, and the several species of *Murchisonia*), are absent from the Californian slates and tilted sandstones. It is stated that no trace of a silurian or Devonian fossil has been discovered in California, or indeed anywhere west of the 116th meridian.

It appears, therefore, that many of the opinions entertained must be modified, and that some of the dicta heretofore accepted must be altogether ignored.

Enough has been done by the quartz miner in this country to prove that veins may be wrought with profit at great depths below the surface; and all the evidence which has been collected would seem to show that the gold in the greater lines of reefs was deposited at the same time as the quartz and other minerals which fill them.

Gold is found in veins in formations ranging from the older palæozoic up to the cretaceous, and is not confined to the silurian rocks. As already stated, it is found in the secondary or mesozoic rocks of this colony, and in those of the same age in Queensland;† it is wrought in rocks of carboniferous age in Nova Scotia;‡ and in California veins traversing strata of jurassic and triassic age give good results, both on the surface and at great depths.§

* *Siluria*, third edition, page 475. It is somewhat remarkable that in the close vicinity of the few places where we find good roofing slates, quartz veins are either absent or so poor as not to be worth working.

† Rev. W. B. Clarke, F.G.S., in *Dicker's Mining Record*. He says that gold has been "detected at the mint from even secondary rocks of Queensland;" and he adds, "I conceive that there is nothing extraordinary in urging the possibility of gold being found in the miocene drifts."

‡ Mr. Hartt, *Can. Nat.*, 1864. "The lower part of the beds of conglomerate or grit, at their junction with the slates, is richly auriferous, the gold occurring principally in the form of flattened scales, sometimes a quarter of an inch in diameter, disseminated through the rock. I have seen many fragments of the conglomerate, not one cube inch in size, on the surface of which twenty or thirty scales of gold could be counted with the naked eye." He states further, on the clearest evidence, that the gold has been derived from veins which intersect the clay-slates.

§ Professor Whitney, *Geological Survey of California*, 1865.

The granites of this colony, at or near their junction with the older sedimentary rocks, contain gold.

On the western slope of the Sierra Nevada, at Soulsbyville, one vein in granite was rich enough to keep three mills at work. Respecting this vein Professor Whitney thus writes:—"The Soulsby vein is enclosed in granite, and stands nearly vertical; it has a strike of almost exactly north and south, magnetic. Its average width is about one foot, the widest place in it being four feet six inches. The granite which forms the wall-rock is exceedingly hard and compact, and the vein perfectly well-defined and very rich in the sulphurets of iron, lead, copper, and zinc, the two former however in much the largest proportion. Near the surface, where the sulphurets were decomposed, the vein-stone was worked with great profit; its average yield, in 1861, was fifty dollars per ton, although some of it has produced six or seven times as much.

"Two mines were worked on this vein, one called the Soulsby, and the other the Platt mine; each of these had a mill, the first one of twenty stamps, the other one of ten. The Gilson mill, a few rods south of the Platt mill, was built to run on rock from another claim on the same vein; this was also a ten-stamp mill, and was running in 1861 on rock from the Draper vein. This vein is one and a-half mile from Soulsby's, and is also enclosed in granite, and very nearly of the same character as the Soulsby vein. At Lomberdo's mill, two miles east of Soulsby's, there are several veins in the granite, nearly parallel with each other and running about north and south.*

Gold is found, also, in syenitic diorite in this colony; and in the planes of bedding of the older claystones and mudstones (silurian).

It is necessary to bear these facts in mind: they have a value altogether independent of their significance in geological investigations, because they may lead to explorations which will add to the permanent wealth of States.

There are large areas in this colony, occupied by rocks exactly similar in character to those profitably wrought in other countries, which have never been properly prospected by the miner. One successful operation might result in giving useful employment to thousands of men; but if we shut our eyes to what is going on in other parts of the world, and steadily abide by the old theories, our material interests and the interests of science will alike be injuriously affected. Many failures may involve a certain relatively small loss, but we should never forget that, in physical researches, these are the necessary preludes of success.†

* *Geological Survey of California*, 1865, p. 238.

† A theory has lately been promulgated which may be concisely stated in the following terms:—

- 1st. That a set of what are believed to be older quartz veins was formed prior to the miocene gravels.
- 2nd. That these veins are non-auriferous.
- 3rd. That the gravels of the miocene age are necessarily non-auriferous.
- 4th. That a second set of auriferous veins was formed subsequent to the deposition of the miocene strata.
- 5th. *That the first set of non-auriferous veins was formed by forces in operation as long prior to those which produced the gold-bearing veins as the denudations producing the barren miocene gravels were prior to those which gave rise to the pliocene productive ones.*

Now, whether we regard the auriferous veins as huge fissures—some of them 150 feet in width—which have been caused by extraordinary disturbances in the crust of the earth, or as lines which, in obedience to some obscure law, have become veins by the removal, molecule by molecule, of the original substance, and the substitution therefor of quartz vein-stone, gold, and other minerals, we

When the attention of the miner was first directed to the auriferous veins, he quarried the stone on the surface, and was well satisfied with the small pieces which he was able to extract by using a hammer. So little was known generally in the early days of the goldfields of the modes of occurrence of gold, that pieces of quartz, containing only small particles of gold, and worth perhaps a few shillings, were readily sold for £10 and £15. They were eagerly purchased and set as rings or pins. When finally the miners saw reefs rich in gold, huge fragments of quartz—moss-covered and weather-stained—everywhere intersected by veins of iron pyrites and gold, they set to work in earnest; and by such rude implements as they were possessed of—often only a hammer and a mortar—they were able to earn as much as £6 and £10 per week.

On some of the older goldfields one can still see veins but imperfectly opened. The quartz was taken out; a feeble attempt was made to prevent the sides from falling in by placing timbers across from wall to wall; but as soon as difficulties occurred, as soon as the water became troublesome, and the labor of hauling up the quartz in small tubs from a depth of twenty or thirty feet considerable, the work was abandoned; and fresh proofs were given that mining in quartz lodes at any depths exceeding thirty feet was unprofitable. Thus matters might have remained until this day—and thus might the theories of some geologists have been apparently established—had not enterprising miners, possessed of ability and capital, and not deterred by previous failures, set to work to penetrate the veins by shafts and adits in such a manner as to prove their value.

The quartz quarried on the surface was not, at first, sent to mills to be crushed. Only such pieces as showed gold were broken, and consequently the yield per ton was represented as something extraordinary. And even after the mills were erected it did not pay the miner to crush any but the richest quartz, because the cost of treating it was very great. Now, quite poor quartz—giving less than half a-pennyweight to the ton—is often sent to the mills together with other richer parcels. In conducting a mine at the present time, the manager is often obliged to crush all the quartz. Whether

are asked to believe that these changes (acting from below upwards) stopped short when the lowest stratum of the miocene gravels was reached; that all the palæozoic rocks were in a state of violent activity, and that all the superincumbent strata (including the mesozoic and carboniferous rocks, where they occur) were in a state of repose.

This is a difficulty not before presented, I believe, by those who have adopted this theory.

If the auriferous quartz veins were formed subsequent to the deposition of the miocene gravels, we bring the formation of them within a definite geological period, and we naturally enquire—What was the position of the palæozoic rocks which are intersected by highly auriferous veins during this period? We know, from even a slight examination of the topographical features of the country, that masses of them were standing as large islands above the sea in whose bed the miocene rocks were deposited.

Then, as a logical conclusion, the great and important changes, which resulted in their being intersected by these numerous veins, were effected while the rocks were exposed to the air and the atmosphere—when trees were growing in the soil, and the dews of heaven were wetting the grass.

It is not necessary to pursue the subject further. The auriferous veins are formed on the same plan as the non-auriferous veins (if indeed any be non-auriferous); and when we contemplate the operations of Nature in other aspects, it is easy to believe that none of the veins were formed exactly to suit the degree of excellence of manipulation which makes the difference between what are called *payable* and *non-payable* veins.

To suppose that all the vast denudations, which we know the auriferous rocks have been subjected to, occurred within the limited geological period assigned to them by this theory, is certainly contrary to the views of the writer of this paper, and, in his opinion, opposed to the facts which have been cited.

it be rich or poor he cannot tell until it is crushed, because the gold is often distributed through the vein in fine particles, quite invisible to the naked eye.

Now that the crushing and treatment of the quartz is inexpensive, it is worth while to send much of the included slate and mullock to the mills. It is cheaper to do this, than to pick the quartz; but in consequence of these practices the apparent average yield of gold from quartz is reduced.

Whether the vein is wrought by sinking shafts and driving from thence, or by tunnels, or by quarrying on the surface, all the best appliances, as used in other mining countries, are brought into use by our miners, who in perseverance, skill, and intelligence are not excelled by the same class in any country.

In the Beechworth District, where the hills are high and steep, and where the reefs commonly crop out on the summits of the ranges, we find tunnels run into the hills, whence the quartz is brought down by trucks, running on self-acting inclines to the mills, which are in many places economically worked by breast, undershot, or overshot waterwheels.

From the descriptions which follow, it will be seen that we have no reason to be ashamed of our machinery or the appliances for treating massive quartz or saving fine gold.

On all the higher points of the range, east of the River Yarrowee, at Ballarat, quartz reefs appear at the surface, and they are generally of considerable thickness. And on the west side, beneath the basalt and the drift, numerous veins have been discovered. The map which accompanies this paper shows the position and extent of these better than any written description could do. It is noticeable here, as in other places of the like geological features, that the veins have served in some measure to protect the rocks which they intersect from erosion. Wherever the palæozoic rocks are laid bare, whether they be covered by drifts and basalt or not, the place which the out-cropping quartz vein occupies is an umbo, strongly or feebly marked in proportion to the extent, thickness, and ramifications of the vein.

Many of the veins which have been laid bare by deep sinking under the basalt are as much as 300 feet below the outcrops of the veins in the adjacent eastern ranges; but their peculiarities are everywhere distinctly marked.

The section of the quartz reef on the Old Post Office Hill, prepared by Mr. Thomas Cowan, mining surveyor, some years ago—and which accompanies the plan of Ballarat—is still, from its position, very interesting. The quartz in some parts of the mine gave as much as 8 dwts. to the ton; and at the time I examined the workings the owners were crushing about 250 tons per week. The direction of the vein in nearly every part is the same as the strike of the rocks. The workings were dry in all the levels shown in the section; but in the neighboring claims water was struck at a point some twenty feet below the deepest level, which would nearly conform to the level of the bed of the River Yarrowee.

All through the rocks adjacent to the vein small strings of quartz could be seen shooting out from the main lode.

At the Black Hill, the summit of which is about 240 feet above the bed of the River Yarrowee, and which forms a part of the quartziferous ranges, from whence the gold of the leads has been derived, very important mining operations have been conducted for a long period.

Mr. Harrie Wood, the district mining registrar at Ballarat, has compiled a statement, from which the following facts are derived:—

“The quartz is not found in a defined lode, but consists of strings or veins,

varying in thickness from twenty feet (and in one case where two large veins come together from forty feet) to a few inches, having a general course of seven or eight degrees east of north, mostly nearly vertical, but in some cases horizontal; one vein having been worked horizontally as much as thirty feet, for a distance of 400 feet along the course of the vein, which in no part exceeded eighteen inches in thickness. The width of ground containing these quartz veins is at the surface more than 300 feet from east to west, and the ground actually taken out by the company is about 240 feet wide at the surface, narrowing to 150 feet at a depth of 100 feet down. The length so excavated is about 650 feet from south to north. Below 100 feet from the surface the quartz is mined from shafts in the usual manner, and is being worked as low as the level of the creek, or about 220 feet below the original surface. One shaft has been sunk fifty feet below the level of the creek, but no quartz has yet been discovered at that depth. As the depth from the surface increases the veins are not spread so uniformly through the ground, but have the appearance of forming into one or more large lodes or aggregation of veins. One large lode, after being followed down about 100 feet, appears to have run out altogether. The explorations are, however, insufficient to afford grounds for an opinion on the probability of the quartz forming a lode or lodes as the depth increases. Up to the 31st December, 1864, the quartz was got by open working like a stone quarry or railway cutting, the whole of the ground being thrown down, the quartz picked out and sent to the mill, and the sandstone rock run out and tipped on the west side of the hill.

"The company have sixty stamps, weighing 700 lbs. each; and they are capable of crushing ninety-six tons of clean hard quartz per diem of twelve hours.

"About ninety-six tons of clean hard quartz is about the average quantity actually crushed, but when the veins are small and much mixed with sandstone and slate, as much as 120 tons may be put through in the same time.

"Up to December, 1864, while getting quartz wholly from the open cutting (the mill working twenty-four hours per day), the total number of tons crushed was 147,639, yielding 16,344 ozs. 16 dwts. 13 grs., the average yield per ton being 2 dwts. 5 grs.

"During 1865, while getting the quartz partly from open cutting and partly through shafts, the mill working about twelve hours per day, the total number of tons crushed was 27,209, yielding 3,249 ozs. 19 dwts., the average yield per ton being 2 dwts. 9 grs.

"From the 1st January, 1866, to the 30th September, the quartz was obtained wholly by mining, the mill working about eight hours per day. The number of tons crushed was 15,270, yielding 3,207 ozs., the average yield per ton being 4 dwts. 4 grs.

"The total quantity of quartz crushed by this company is 190,118 tons, yielding 22,801 ozs. 15 dwts. 13 grs., the average yield being 2 dwts. 9·7 grs. per ton.

"The cost of the company's machinery, &c., is £10,030 11s. 3d., and the cost of claims purchased is £24,235 17s. 8d. Total cost, £34,266 8s. 11d.

"The number of men employed by the company when in full work is 120, the number at present employed is seventy.

"The average rate of wages is 7s. 6d. per diem; viz., for miners 8s., second 7s. 6d., boys 6s.

"The cost per ton of getting quartz from open cutting is 4s. 2d. per ton, from levels through shaft 8s. 6d. per ton, and the cost of crushing is 4s. per ton.

"The company's plant consists of a battery of sixty stamps, on the revolving principle, each stamp weighing 700 lbs. and making about seventy blows per minute,

with a fall of nine inches; and the quartz is fed to the stamps from the hoppers by a self-acting apron.

"The motive power consists of a double cylinder horizontal engine of 100 horse-power, supplied with steam from four Cornish boilers, and driving, besides the stamps, two thirteen-inch plunger pumps, raising 500 gallons of water per minute for the supply of the battery; and a fan which supplies the smith's forges and blasts for the foundry when smelting iron for the castings, which are all made on the premises; the engine also works the amalgamating barrels, and a large-sized lathe used for turning the stamp shanks and discs and screwing them.

"The company obtains its water supply from the Yarrowee Creek, which runs through the claim, the water being conserved in a reservoir capable of holding 1,500,000 gallons. During the dry season, the water and tailings from the battery are run into settling pits, and the water is used over again.

"The quartz from the mine is brought to the mill through an adit 800 feet in length, driven into the hill about fifty feet above the level of the hoppers and shoots, on the face of the hill from the adit to the hoppers.

"The company does not use a stone-breaking machine, as the quartz is easily broken by means of hammers.

"The company does not employ any means for saving the fine gold, other than the ordinary mercury ripples and blanket strakes."

Additional information relative to the machinery has been furnished by Mr. Pritchard, under whose direction it was erected. He says:—

"The machinery is erected upon the Yarrowee Creek, at an elevation of 200 feet below the summit of the Black Hill, and about forty feet above the level of the creek. The site for the machinery is hewn out of the solid rock, and the engine and battery are erected in the most substantial manner. The engine has two eighteen-inch cylinders, three feet stroke, with four Cornish boilers, each twenty feet by five and a-half feet diameter. The battery consists of sixty stamps equally divided upon each side of the engine—these are upon the revolving principle—and the cams and discs are of malleable iron, and faced with steel; and the lifters or shanks are of turned metal, having a thread cut upon the portion necessary for receiving the disc. The weight of each stamp is 700 lbs., and the average lift nine inches—the number of blows per minute being seventy-five per stamp. All the stamps are provided with self-feeding apparatus, and these answer so satisfactorily that the occasional attendance of one boy is sufficient for supplying the whole battery with the material brought to the hoppers. The stamp-boxes have gratings of 120 holes per square inch fitted to each side of the box; and I introduced the plan of having amalgamating troughs and blanket strakes, both in the front and at the rear of the battery, which, by using a larger quantity of water, distributed the reduced material over a proportionately increased surface, and thereby tended to improve considerably the effectiveness of the system of troughs and blanket strakes. The blankets (or more properly the green baize) are changed every four hours or oftener, according to the estimated auriferous character of the stone. Hot water is used; and the material collected from the blankets is placed in barrels, and revolved with mercury for ten to twelve hours, whereby the gold is extracted—to be afterwards retorted with the amalgam obtained from the troughs and stamp-boxes. The gold obtained from the different parts of the reduction machinery averages about seventy per cent. from the stamp boxes, twenty-five per cent. from the mercury troughs, and five per cent. from the blanketings.

"The Black Hill Company are singular in having a foundry on the premises, where all the castings are made; and, as economy in working expenses has throughout been the point aimed at, it is interesting to see the extent to which this principle is carried in casting stamp-heads. Every imported brand of pig iron has been tried separately and by mixtures, and the best quality for the purpose has been proved to wear double the length of time to that previously used.

"The water supply is obtained from the Yarrowee Creek, collected into reservoirs of 1,500,000 gallons capacity, and pumped, by a double thirteen-inch force pump, into 7,000 gallon service tanks, from which the water is distributed to all parts of the establishment.

"The quartz was found cropping out in the crown of the Black Hill; and, to the depth of about ninety-five feet, the stone was in large masses—in some places 120 feet thick—in other parts reduced to twenty feet in thickness. The gold was not found permeating the whole mass, but chiefly in leads or runs—three of these runs of gold being the general rule.

"Below ninety-five feet the quartz has every indication of narrowing into a more defined lode.

"At about seventy-five feet above the mill the hill is pierced by tunnels, seven feet high by six feet wide, through which the wagons containing the quartz are conveyed upon iron railways of four and a-half feet gauge."

The records of the Mining Department show that the average yield of gold from quartz crushed at Ballaarat is very low. This, instead of having a prejudicial effect on mining operations, generally, has been singularly beneficial. It has induced economy in working, brought into use and to completeness many excellent appliances for saving fine gold, and has served to train managers and workmen better and more effectually than any mining school teaching could do. If not a direct benefit to Ballaarat, it has had a remarkable effect on quartz mining generally; leading to the use of simple, easily-worked appliances, and proving that care and skill in the use of these are often sufficient to compensate for any inherent defects in them.

All the quartz veins at Ballaarat are, however, not poor. One of the companies at Little Bendigo, near Ballaarat, have lately been bringing out quartz from levels as deep as 570 and 650 feet. The vein they are working is said to be from twelve to eighteen inches in thickness only, but the yield is about $1\frac{1}{2}$ oz. per ton.

From the reports made by the manager of one of the quartz mines at Ballaarat, it appears that in less than seven months the company crushed 7,453 tons of quartz, which yielded no more than 2 dwts. $10\frac{1}{2}$ grs. per ton, and yet they paid in dividends £2,101 10s. The average quantity of stone crushed per week was 257 tons, and the total cost of winning the gold, including shareholders' labor and wear and tear of machinery, was estimated at 5s. 4d. per ton.

A report made by Mr. Hugh Gray, to the directors of the Prince of Wales Company, contains, among other interesting facts, the following:—"Pyrites taken from the shaking tables, and unroasted, gave 16 ozs. 6 dwts. 16 grs. of amalgam per ton of pyrites, and the amalgam yielded 2 ozs. 14 dwts. 10 grs. of gold. The roasted samples gave 5 ozs. 10 dwts. 16 grs. of gold per ton. Other assays gave 4 ozs. 10 dwts. 21 grs. of gold, fine, per ton. All the assays weighed 10 lbs. troy each."

Mr. John Lynch, mining surveyor, gives the following not very cheering account of the quartz reefs in the Smythesdale Division:—

"The yield of the Lancashire Reef, at Brown's, was about 1 dwt. 15 grs. per ton, and the thickness of the vein from one to ten feet. The quartz contained pyrites all

through. The depth attained was 100 feet, and the depth of the water-level about the same. On the surface the quartz gave as much as 10 dwts. per ton. Mullocky Point, at Brown's, is from two to eight feet in thickness; but no results are recorded. The Britannia Reef, at Carngham, has yielded 6 dwts. per ton. It is ten feet in thickness. The depth of water-level is 100 feet, and the deepest shaft 500 feet. In the lowest parts the yield was 5 dwts. per ton. There is much pyrites in the stone, and a kiln was used for reducing it. The Result Reef, at the same place, has given 7 dwts. per ton. The vein is from ten to fifteen feet in thickness, and the greatest depth attained is 280 feet. At 220 feet the yield was as stated above, but the 280 feet level was never opened.

"The North German Reef, at Smythesdale, has yielded 18 dwts. 1 gr. per ton. It is from two to three feet in thickness, and has been opened to a depth of 60 feet. The water-level has not been reached as the yield decreased, as the vein was followed downwards, and the mine was abandoned. Respecting the Yankee Reef, at Happy Valley, there are no records obtainable. It is abandoned.

"Between Carngham and Linton's, the Hard Hill Reef occurs. It has given about 3 dwts. per ton. It is four feet in thickness, and has been worked down to the water-level, which is found at ninety feet.

"Captain Finn's Reef, between Italian's and Derwent Jack's, has produced 2 dwts. per ton. It is four feet in thickness, and was found unproductive at a depth of fifty feet.

"The Springdallah Reef has yielded 5 dwts. per ton. It is five feet in thickness. Below the water-level, which was found at eighty feet, the quartz is largely mixed with iron pyrites.

"The Victoria Reef, at Brown's, gave about 1 oz. per ton on the surface, but the yield rapidly fell off as the lode was followed. It is about six feet in thickness.

"Kelly's Point, the only reef now being worked in the division, has yielded 3 dwts. 16 grs. per ton. It is eight feet in thickness, and has been opened to a depth of 100 feet, the water-level being found at sixty-five feet."

All these reefs are poor, and the proportion of the pyrites in the quartz is very large. It must not be concluded, because the reefs have been abandoned, that the quantity of gold in the veins is less in depth than on the surface. The cost of getting out quartz, keeping the mine clear of water, and treating pyrites, would not be covered by a very small yield, unless the works were conducted on a large scale, and with the best appliances.

Near the eastern sources of the Little Woody Yaloak Creek, we find the Staffordshire, Penrose, Frenchman's, Pinchgut, and Mount Misery Reefs. None of these have been extensively wrought. The Staffordshire vein has yielded sometimes very well. One parcel of 78 tons gave 191 ozs. 14 dwts.; and the gross yield obtained from 784 tons was 919 ozs. 1 dwt. 3 grs.*

Remarkable results have been obtained at Clunes, where one of the best-conducted mines in the world is to be seen.

A small patch of palæozoic rocks, islanded in basalt, and situate on a tributary of the Deep Creek, about seventeen miles in a north-westerly direction from Ballarat, is intersected by persistent veins of quartz. These, as well as the leads which trend thence, have been explored, and if we may judge of the under-surface of the vast

* *Mining Surveyors' Reports*, November, 1859.

area adjacent, which is covered with basalt, it may fairly be assumed that hundreds of years will not suffice to exhaust this part of Victoria of its treasures.

The Port Phillip and Colonial Gold Mining Company have extensive works at this place, and an account of them will be read everywhere with interest by those who are engaged in quartz mining. Mr. R. H. Bland, the company's agent, has furnished the following statement:—

“There are five reefs included in the workings, and the length of drives in each is as follows:—

	Feet.
Western vein - - - - -	4,460
Robinson's vein - - - - -	6,060
Old Man vein - - - - -	580
Eastern vein - - - - -	8,290
Welcome vein - - - - -	1,020
	20,410
Add cross-cuts - - - - -	5,180
Giving a total of - - - - -	25,590

which is equal to $4\frac{1}{2}$ miles.

“The depth of the main shaft is 464 feet; but little quartz has, however, been taken out below the 374 feet level. The length of the claim in the direction of the strike of the reefs is 440 yards, or a quarter of a mile. The thickness of the reefs varies very much, and may be stated as follows:—

	Feet.
Western vein, about - - - - -	9
Robinson's vein, varying from 3 to - - - - -	30
Old Man vein - - - - -	150
Eastern vein, about - - - - -	4
Welcome vein, varying from 6 inches to - - - - -	30

“These veins are larger in depth, as well as more irregular in size.

“The length of tramways on the surface, for the conveyance of quartz and mullock, amounts in the aggregate to about 2,500 feet of single track. The engine-power used in hauling and pumping at the two shafts is about eighty-five horse-power.

“*Character of the Veins.*—There are five principal veins, the middle one being for the most part hard barren quartz, and on each side of this non-productive mass there are two veins running nearly north and south in the direction of the strike of the slate. The westernmost veins underlie west, and those on the eastern side east. The quartz occurs in these veins in large shoots, dipping north and south in opposite directions from the summit of the hill. These shoots of quartz are in some places thirty feet wide, while the continuation of the vein immediately above and below them is small. The quartz in three of the veins is of a more or less brown compact character, and not generally hard; but in the two middle veins it is white, and more associated with raw pyrites, and of a harder nature. The pyrites occurs in veins and patches, and when accompanied by galena is generally rich. The gold mostly occurs in the lines of fracture in the quartz, but it is sometimes seen at the side of the quartz in the slate, and the most auriferous quartz dips north and south with the shoots above alluded to. This is more particularly the case as the mine gets deeper. The veins are in some places laminated, and in others homogeneous. Gold occurs both in the laminar and massive quartz, and in the joints and fractures, and especially where seams

of pyrites have been formed. Gold is frequently more abundant in the large lodes, on or near one of the walls—either the foot or the hanging wall.

“Cost of Raising Quartz.”—This may be set down at an average of about 13s. per ton, including cost of machinery and dead work in the mine, and delivery at the reduction works. The contracts for breaking out the quartz underground average from 4s. to 9s. per ton.

“Surface Operations.”—The quartz when brought to the surface is separated into two lots. The small size is tipped into a large hopper, and from thence drawn and delivered direct to the stamps; and the larger lumps are sent to the stone-breaking machines to be reduced to a size suitable for the stamps. Two of these machines are in constant use, working an average of about ten hours per day. Each machine will break about eight tons per hour when in good order, at a cost, including wear and tear, of about 10d. per ton. They are driven by a shaft from one of the battery engines, and take about twelve horse-power to drive the two.

“The number of stamps at work is eighty, as follows:—*Fifty-six heads* of about 6 cwt. each, including lifter and tongues, driven by one twenty-four-inch engine, giving about seventy-five blows per minute, taking about one horse-power per head, and crushing an average of about 2 tons 4 cwt. per head for twenty-four hours; *twenty-four heads* of about 8 cwt. each, including lifter, &c., driven by a twenty-four-inch engine, giving seventy-five blows per minute, taking in the aggregate about thirty horse-power. These stamps crush about 4 tons per head per diem, and they have a larger proportion of the small material sent to them. The average quantity of quartz crushed per week of five days is about 1,130 tons.

“The following is a return of quartz crushed for the twelve months ending September, 1865:—

Quartz.	Gold.	Average per ton.
54,413 tons	20,596 ozs. 10 dwts. 12 grs.	7 dwts. 13 grs.

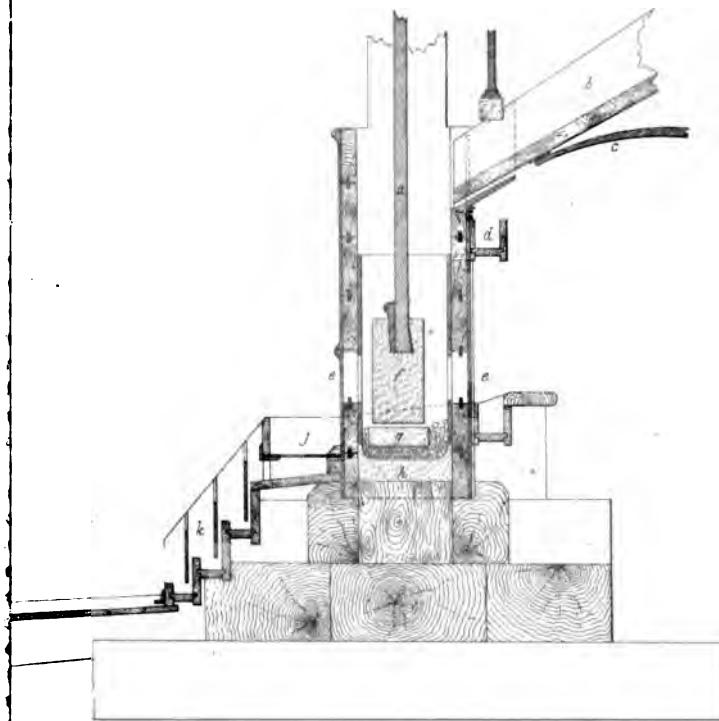
“The gold above mentioned was collected in the following way:—

Stamp beds	-	-	-	-	-	-	66·08 p. c.
Mercury boxes	-	-	-	-	-	-	22·95 p. c.
Blankets	-	-	-	-	-	-	10·97 p. c.

“The quantity of water required to work the stamps efficiently is about eight gallons per head per minute, which is 921,600 gallons per diem.

“Method of separating Pyrites from the Tailings.”—The *tailings*, on leaving the stamps, run into settling-boxes, where the current is checked, and the heavier material settles. These boxes are cleaned out every few hours, and the material sent to the *buddle*, where it undergoes a further concentration, and is dressed up to an average of 3 ozs. or 4 ozs. of gold to the ton of material. This is then sent to the roasting furnace, and afterwards ground in Chilian mills with mercury; and an average of about eighty-five per cent. of the assay contents of the gold is thus extracted. The cost of operating on the pyrites, including the *buddle*, roasting, grinding, loss of mercury, &c., averages about £2 14s. per ton, or about £1 per ounce of gold obtained. The expense will diminish as the quantity of pyrites increases, and it improves in richness.

“Gold Crystals.”—These are obtained from a mercury-box placed at the foot of the blanket strakes, which is placed there to catch stray particles of mercury, occasionally driven out of the upper boxes, as well as any fine gold that may have passed the blankets. These boxes are cleaned out about once in four or six months, and it is found that the gold contained in them has become crystallized. The largest



SCALE, 3 FEET TO ONE INCH.

Lithographed at the Department of Lands and Survey, by Stuart B. Bennett

Melbourne, September 4th 1868

crystal we have noticed was the size of a pea. The crystals would no doubt increase in size if left for a longer period.*

"Quantity of Quartz Crushed.—The quantity of quartz crushed and yield of gold, from the commencement of the company's operations in 1857 to the 31st July, 1866, is as follows :—

Quartz Crushed.	Yield of Gold.
308,661 tons - - - -	180,723 ozs. 15 dwts. 10 grs. -
Equal to 6 tons of 2,000 lbs. each.	

* Some of these crystals were exhibited in the Intercolonial Exhibition. Mr. George F. Ulrich, the mineralogist, thus writes respecting these interesting products :—

"The formation of crystals of gold amalgam in the mercury troughs below the blanket tables, at the Port Phillip Company's works at Clunes, is interesting in a scientific as well as in a practical point of view.

"No occurrence of this kind has been recorded in any work on metallurgy. Natural gold amalgam in small white grains, easily crumbling, has been found in the platinum region of Columbia, the composition being—Mercury, 57·40; gold, 38·39; silver, 5·0.

"There have been silver amalgam crystals produced at the smelting works of Joachimsthal, in Saxony; and according to Mr. Rosales, Wherle says, in his *Metallurgy*, that if the quicksilver of gold amalgam is very slowly evaporated, the gold will appear crystalline and in small crystals at the surface; but neither of these cases can compare in interest with the formation of the gold amalgam crystals at Clunes, which seem to have formed at the bottom of the mercury troughs, in the same way as any salt shoots out in crystals from its saturated solution in water. The formation of the Clunes crystals can only be viewed in this light. The extremely fine gold escaping from the blankets must have been dissolved in the quicksilver, as it would be in *aqua regia*. In course of time the quicksilver became thus more and more charged or saturated with gold, till a point, the limit of saturation, was reached, when probably, favored by the constant steady influx of the water and the vibration of the trough, caused by the concussion of the stamps, the process of crystallization commenced, and proceeded slower or quicker in proportion to the rate at which the gold was supplied from the blankets. Had the troughs remained eighteen instead of nine months undisturbed, the crystals, which now with few exceptions are very small, might have become much larger. With regard to the chemical composition of the crystals, they appear to contain only a small per centage of quicksilver, with a relative fixed per centage of gold, and are, in fact, an ore or mineral; in this respect the analogue of the rich silver amalgam, the *arquerite*, from the mines of Arqueros, near Coquimbo, which contains 86·5 Ag., and only 13·5 Hg., whilst the native gold amalgam from Columbia seems, by its large per centage of quicksilver, 57·40, more analogous to the common silver amalgam of Almaden, Idria, &c., which also contains 60 to 73 of quicksilver. That the quicksilver only forms a small per centage in the composition of the Clunes crystals, is probable from their hardness, which is about 3·5, whilst the Columbia ore is 1, and further, from the fact that when treating the crystals in nitric acid, as done by Mr. Latta, assayer at Clunes, they do not become loose and spongy, as would have happened if the quicksilver had been present in any large proportion, but they preserve all the appearance and lustre of solid gold crystals; a peculiar concavity of the crystal planes, and innumerable small hollows and cracks (the latter distinct from the striations of crystallization) visible only under the microscope, prove, however, the removal of the quicksilver.

"On close examination of several very small crystals, the octahedron appears prominent, the corners or solid angles always truncated by the cube, and the edges by the dodecahedron. On some crystals, however, distinct hemihedral planes of the trapezohedron occur (hemi-trisectahedron) and also, though more obscure, those of the trisectahedron. The recognising and proper holding of the crystals is generally difficult, as they are more or less distorted, mostly pressed flat in the direction of one axis. Crystals resembling rhombic prisms, with terminal planes, similar to heavy spar, are very frequent.

"Another form of gold amalgam in bunches of microscopic acicular crystals (apparently six-sided prisms, with oblique terminal planes resembling hornblende) are produced, if fine gold is slowly dissolved in mercury and pressed through chamois leather. If this amalgam is treated with nitric acid, the crystals remain exhibiting a fine gold lustre, which is little liable to tarnish by the atmosphere."

“ Timber used and Methods of Timbering.—The quantities, description, and prices of timber used at the mine and reduction works for twelve months are as follows :—

“ For props: 60,000 feet—box and blue gum; £12 per thousand feet (run.); carted a distance of fourteen miles, from a locality about north-west of Clunes.

“ Laths: 16,000—stringybark; 24s. per hundred; carted from a forest about twenty-five miles easterly from Clunes.

“ Squared logs: 1,200 cubic feet—box; 1s. 10d. per cubic foot; got about twelve miles from Clunes.

“ Sawn timber: 200,000 feet, running measure; price 6s. per hundred; carted about fifteen miles.

“ Firewood: 3,600 cords (of 128 cubic feet each)—box, ironbark, and red gum, the two former preferred; cost 25s. per cord; and carted about eight miles.

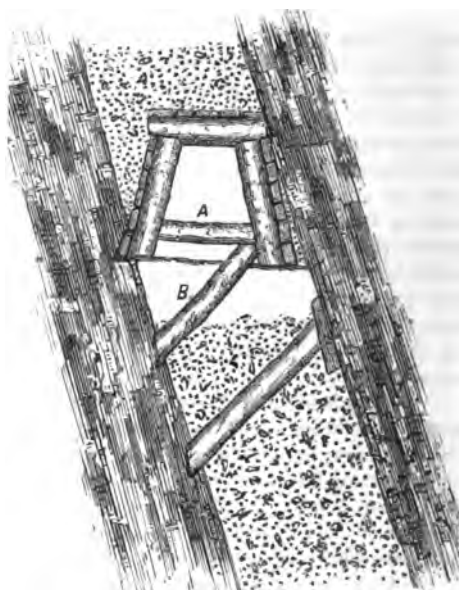
“ The total cost of timber is as follows :—

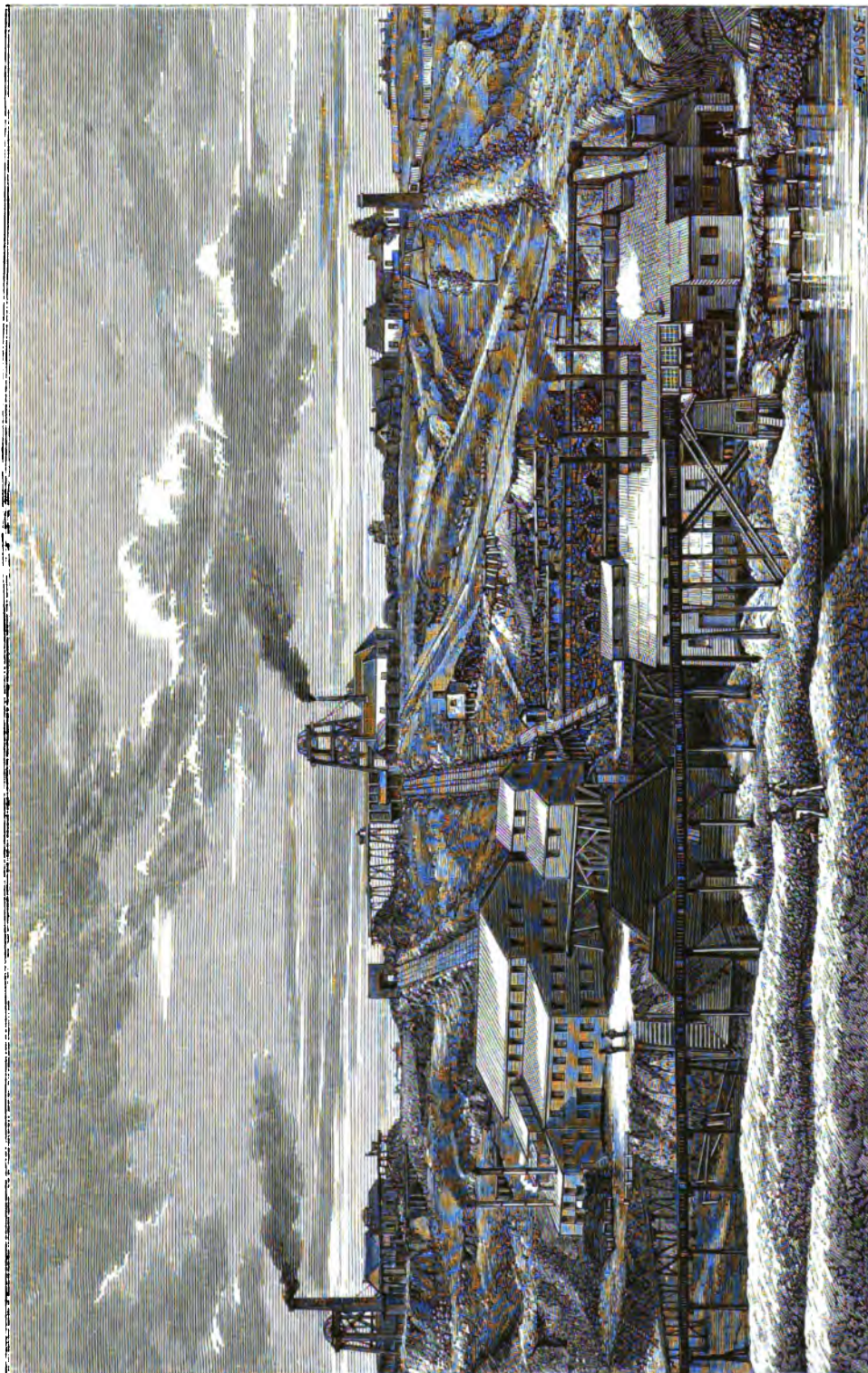
	£	s.	d.
Props—60,000 feet—£12 per 1,000	720	0	0
Laths—16,000—24s. per 100	192	0	0
Logs—1,200 cubic feet—1s. 10d. per cubic foot	110	0	0
Sawn Timber—200,000 feet—6s. per 100 feet	600	0	0
Firewood—3,600 cords—25s. per cord	4,500	0	0
	£6,122	0	0

“ The usual method of timbering the drives is by applying what miners call ‘ frame sets,’ consisting of two standards and a cap-piece, as shown in the accompanying sketches—the loose side, ground, and roof being secured by laths, generally about four feet long and eight inches wide, driven behind the standards, and over the cross-pieces. When the ground is not stiff enough in the bottom to support the standards sole pieces are added, upon which the tramroad is also laid; and underneath, when required, is formed a channel for the water.

“ Fig. 55 represents the method of securing a drive in a narrow lode, as the stope approaches it from below. Before the excavation reaches the bottom of the drive the standards of the drive sets are well secured apart by the application of cross-pieces, A—care being taken that the frame-set is kept at right angles with the direction of the excavation; the lateral pressure of the sides then keeps the timber securely fixed; and, as the ground is carefully opened from underneath, the leg sustaining the chief pressure is generally further secured by a strut, as at B, and the excavation filled in with refuse as the quartz is taken out.

FIG. 55.





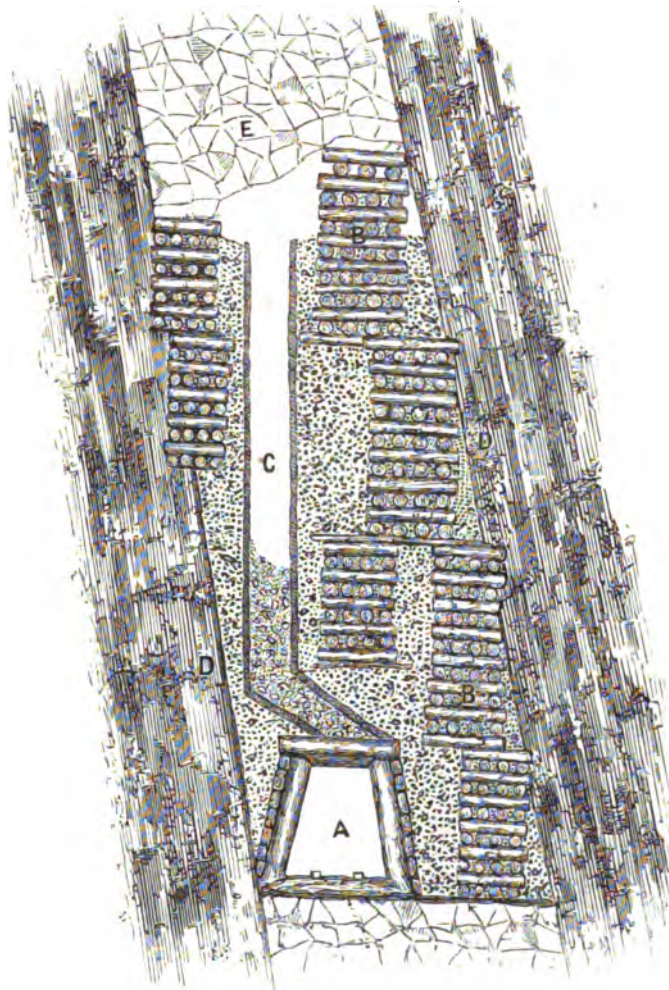
From a photograph by Nettleton.

WORKS OF THE PORT PHILLIP AND COLONIAL GOLD MINING COMPANY, CLUNES.

" Fig. 56 illustrates the method of working a stope. A drive is in the first place opened on the vein, as at A, and the quartz taken out all the breadth of the lode, as high as the drive, and the excavation filled in with rubbish. When stoping commences this portion of the excavation is reopened, and the quartz taken down from the roof by the usual process of blasting — pillars of split timber, about four feet square, marked B, being reared up, as close as possible, under the quartz, to secure it, and prevent any loose portions giving way. When these pillars have got to such a height as would be dangerous to continue trusting to their support, the open parts of the excavation between them are filled in with rubbish procured from a pass from the next level above; and so the operation of taking out the quartz and securing the ground continues. It is necessary to keep an open 'mill' rising with the stope, for the purpose of receiving the broken mineral, where it is allowed to accumulate, till taken away by the truckers at the next drive below.

" The method of timbering shafts generally practised at Clunes is by rectangular sets, slightly morticed at the ends and secured with battens; the sides being kept apart in the middle by dividings, to which are also fixed guides for cages. Sawn timber may be used when the pressure of the ground is not excessive, and timber for this purpose varies in thickness from four to nine inches; but in cases where the pressure of the ground sunk through is great, round logs for the sets, trimmed down only sufficient to make them fit each other in the shaft, are found most advantageous. In wet loose ground the process of piling is resorted to.

FIG. 56.



END VIEW OF STOPE.

- | | | |
|------------------------|------------------------------------|---------------------|
| A Main drive. | B Pillars of firewood. | C "Mill" or "pass." |
| D D Walls of the lode. | E Top of excavation in the quartz. | |

"The operation of sinking shafts in wet ground, as practised by miners from the west of England, is generally in the following manner:—The first frame-set is well secured in hard ground, and then laths are driven down behind it, taking care to keep the laths close together, and well ahead of the sinking. When a sufficient depth has been sunk, say three or four feet, another set is fixed under the first, and hung to the first set with bars of iron. Laths are then again driven down behind this set, inside the points of the first tier, and the set fixed and hung with bars to the last; and so the process is continued till the difficult ground is passed through.

"*Wages.*—The wages paid at the mine are as follows:—

					<i>s.</i>	<i>d.</i>
Engine drivers, first class	-	-	-	per diem	12	6
Ditto, second class	-	-	-	"	11	0
Ditto, third class	-	-	-	"	10	0
Stamp men, first class	-	-	-	"	12	6
Ditto, second class	-	-	-	"	10	6
Ditto, third class	-	-	-	"	9	0
Blacksmiths	-	-	-	"	12	0
Strikers	-	-	-	"	8	4
Carpenters	-	-	-	"	12	0
Firemen	-	-	-	"	9 <i>s.</i> to	8 4
Laborers	-	-	-	"	8	0

"The cost of driving in quartz varies from £3 to £25 per fathom, according to the ground; and stoping from 4*s.* to 8*s.* per ton. Cross-cuts in slate from £3 to £9 per fathom.

"The cost of sinking engine shafts varies from £20 to £60 per fathom, depending on the character of the ground. In ordinary ground the cost is from £30 to £40 per fathom.

"The copper platt is perforated to eighty-four holes to the inch.

"The mine is lighted with candles, and the cost per annum is £600.

"Ordinary single cages are used; and the ropes are flat hemp ropes, costing £125 per pair of 100 fathoms each. They generally last twenty-four months."

Information respecting this mine is eagerly sought for by miners in Europe and in America, and too little attention has been given to its system of management in this colony. In any subsequent edition of this work it will be the object of the writer to give a full account of the workings, with such drawings of the machinery, and plans and sections, as may be necessary to explain fully all the excellent contrivances which have been brought into use by Mr. Bland and his officers.

The buddle used at the Port Phillip Company's works is thus described by Mr. James Stevenson, mining surveyor:—

"It is a circular wooden basin, eighteen feet in diameter, having its discharge through an aperture in the centre two feet six inches in diameter, boxes being fixed underneath for conveying the sand away as it escapes. The bottom of the basin is a plane surface, having an inclination towards the centre of half-an-inch to the foot. The rim of the basin is eighteen inches high, with a groove round it for receiving the mineral as it is delivered from pipes attached to a centre-shaft. In the centre of the buddle is an upright revolving shaft, working by belting from the main machinery, and fixed on this revolving shaft is a trough rather higher than the level of the rim of the buddle, where the sand for operating on is conveyed through an open box by water. Attached to the trough are six pipes, discharging themselves at the rim of the

buddle. Six arms are also attached to the revolving shaft, to which are nailed small pieces of cloth for passing over the surface of the sand to keep it smooth. A centre piece is also attached to the shaft, the size of the discharge aperture, which, by rather a complicated mechanical arrangement, is made to rise as the sand rises in the buddle, and so as to prevent its too rapid discharge. The arms are also raised gradually by the same contrivance. On the sand being caused to flow into the trough, and the shaft set revolving, the discharge takes place through the pipes at the rim of the buddle, down the edge of which the mineral flows to the bottom, and on the periphery the heaviest matter deposits itself, as it would on the upper part of a common sleeping table, while the lighter material is washed down by the stream of water towards the centre, and is ultimately carried away through the discharging trough and boxes underneath.”*

* *Mining Surveyors' Reports*, June, 1864.

The following description of an improved buddle, lately erected at Sandhurst, is taken from the *Bendigo Advertiser* :—

“The buddle erected by Mr. Brooke is similar to that at the Clunes. In appearance it is similar to a puddling machine, but instead of harrows there is an arrangement of iron scrapers and brushes, while it is filled, and the sand got rid of, differently. It is twenty-one feet in diameter, and one and a-half foot in depth; the floor has a slope from the outside to a pit in the centre, of one inch in every foot. The centre pit is six feet in diameter. When the machine is in motion a framework revolves on a centre pin, and on the arms of the framework are fastened at equal distances eight one and a quarter-inch tin pipes, about ten feet long. These have a fall from the common centre, which is a small iron bucket, to the top edge of the basin, round which there is a deep groove. These are called the feeding pipes, as they convey the tailings and water which are received by a shoot connected with the tailings heap into the iron bucket to the machine. As the tailings and water discharge from the pipes, they spout into the groove and trickle down the walls of the buddle on to the sloping floor. The gold and pyrites being heaviest remain near the top of the slope, but the particles of quartz being lighter are washed into the centre pit, from which they are got rid of by a shoot into the gully. To keep the tailings loose on the floor, iron scrapers are fastened on opposite arms of the frame, and these, as the frame revolves, stir up the tailings and allow the water to wash the sand down to the pit. This washing down is greatly facilitated by the tailings, which have been carried past the action of the scrapers, being kept perfectly level by means of brushes fastened on to the arms of the frame. When about an inch in depth of pyrites has accumulated, the tailings are turned off and water alone comes through the feed-pipes, and is allowed to run until the particles of quartz are pretty well washed away. The framework with scrapers and brushes is now raised an inch, together with a movable rim round the centre pit, and then tailings and water are again allowed to flow through the feed-pipes until another inch of pyrites has accumulated, when another cleaning takes place, and again the frame is raised an inch. This is continued until there are eight inches of pyrites on the floor of the machine, when they are shovelled out, and laid by for further manipulation. The pyrites is found lying within a foot of the side of the machine; the next three feet in breadth of the floor is covered with pyrites and quartz mixed, and these are put through the feed-pipes a second time; the rest of the floor down to the centre pit is covered with particles of quartz only. Great trouble was experienced in adjusting the slope of the floor, timing the revolutions of the frame, and regulating the flow of water and tailings through the feed-pipes. But these difficulties have been overcome by patient observation and experiment, and the machine now works remarkably well. Two brushes and seven iron scrapers have been found sufficient. The iron scrapers are patented, and for these Mr. Brooke pays £1 a month to the patentee. They are fixed within three inches of each other, four on one arm and three on another. The frame makes nine revolutions in a minute, and about a dray load of tailings is put through the machine in an hour. It is driven by an eight horse-power engine, which is capable of working four such machines, and two men only are required to attend to it and to the engine.”

From subsequent reports, published in the same newspaper, it appears that Mr. Brooke has not been successful in procuring pyrites rich in gold. The machine does its work very well—that is to say, it separates the common iron pyrites from the tailings—but, as suggested in another part

There are rich reefs in the vicinity of Mount Egerton, which is about fifteen miles east of Ballarat. According to a statement made in *Dicker's Mining Record*, they were discovered in March, 1854. Kangaroo, Fisher's, Peter's, and Hick's reefs are well known. Some of the quartz taken from these veins has averaged in large quantities as much as 3 ozs. per ton.

These reefs were wrought for a long period by small parties who could get only very small claims under the bye-laws; but finally a lease of a large area was obtained by Messrs. S. and T. Learmonth, which, under the management of Mr. D. B. Pritchard, Mem. Inst. C.E., London, has come to be a valuable property.

A tunnel, some 1,300 feet in length, has been driven into the hill, and has intersected a vein forty feet in thickness.

Mr. Pritchard has communicated the following facts relative to this mine:—

"In 1863 Messrs. Learmonth purchased, for £7,000 in cash, the whole of the Mount Egerton quartz reef, together with a small engine and battery of eighteen stamps. In former years the yield of gold obtained by individual miners had been fabulously rich; but, from the temporary character of the work performed, the greater portion of the hill had fallen in, and Messrs. Learmonth set to work to open out the ground by a tunnel, upon the plan followed at the Black Hill; after which the battery was improved, and additional stamps erected, and the water supply increased. These works necessitated a considerable outlay, and everyone having a knowledge of the former yields was confident that these works would yield satisfactory returns. Occasionally this was the case, but only after constant and steady perseverance, lasting over four years, has the result been such as Messrs. Learmonth fairly deserved; the more so as they were the first settlers in the district, and who, having acquired large capital as settlers, invested largely in mining—an example few of the pioneers of the colony would care to follow.

"The mine has yielded splendidly for the past twelve months, often over 1 oz. to the ton, and with every indication of permanency; and at the present time Messrs. Learmonth hold one of the most valuable mines in the colony. The lode is well-defined, of great massiveness, in many places forty feet across, and easily reduced. A tramway, having a gradient of one in fifty, is laid from the mine to the mill, with rails of forty pounds per yard, and four and a-half feet gauge. The present machinery consists of a twenty-five horse-power engine, and twenty-three stamps, with mercury troughs and blanket strakes, after the plan of the Black Hill Company."

At Steiglitz there are fifty-six distinct reefs, and some of them are exceedingly rich. Not only in the quartz itself, but in the sulphides also, gold occurs plentifully, some of the latter yielding as much as 22 ozs. per ton.*

Within the small area known as the Steiglitz Goldfield, there lie reefs which would give profitable employment to thousands of skilled miners; and when capitalists give their undivided attention to mining, and themselves superintend the adventures in which they invest their money, this small division will rank high amongst the goldfields of Victoria.

At Mount Blackwood very good returns have been got from some of the quartz veins. The yields have varied from a few pennyweights to several ounces per ton;

of this paper. the common pyrites may not contain much gold. The metal may be enclosed in some other sulphides which differ in specific gravity from the mineral which the machine is constructed to collect.

* *Mining Surveyors' Reports*, p. 370, vol. III.

but here, as in other places, the poor as well as the rich quartz has been sent to the mills.

The following estimate of the cost of raising and treating quartz was made by the mining surveyor, when the machinery and appliances were not nearly so effective as they are now :—

	£	s.	d.
Getting quartz, at 3s. 10 $\frac{1}{2}$ d. per ton, say	-	-	0 4 0
Cartage, per ton	-	-	0 1 6
Crushing, including wear and tear, &c.	-	-	0 3 9
Contingencies	-	-	0 0 3
			0 9 6
A yield of 5 dwts. per ton, at say 3s. 6d. per dwt.	-	-	0 17 6
Deduct expenses, as above	-	-	0 9 6
Leaving a clear profit per ton of	-	-	0 8 0

A parcel of pyrites taken from Simmons' Reef, Mount Blackwood, where it is said it occurs in the vein in the proportion of about one per cent., was tried by the ordinary rude method of crushing and amalgamating, and yielded at the rate of 10 ozs. per ton.

Wilson's, Garibaldi, Newman's, and Barry's Reefs will hereafter be made to yield immense quantities of gold; but this district, like many others, lies almost neglected. Capital in this colony is diverted into so many profitable channels, that it is difficult to get it for even the most promising adventures, unless these be launched by speculators who are well known.

The most important groups of quartz reefs which have yet been explored in the Mining District of Beechworth occur at Yackandandah, Hillsborough, and Stanley, lying immediately eastward of the town of Beechworth; on the Ovens River, south-east of Bright; at Wood's Point, on the sources of the Goulburn; at Alexandra, and at Maindample. Nearly the whole of the large area included within the boundaries of this district is intersected by reefs, but comparatively few have been explored.

Mr. Thomas G. Kennan, mining surveyor, has given some information respecting the Hillsborough reefs :—

"The Homeward Bound is from five to twenty feet in width, and has been penetrated to a depth exceeding 100 feet. The yield varies from 5 dwts. to 1 oz. per ton. The adjacent rock is clay-slate passing into hard grey sandstone, and the quartz in the vein is of a peculiar bluish color. The gold is scarcely to be discerned by the naked eye. A great quantity of pyrites occurs in the vein, and some persons get excellent returns by re-washing the tailings.

"The Taff Reef is from two to twelve feet in width. It has been opened to a depth of 120 feet, and has yielded $\frac{1}{2}$ oz. per ton. The bounding rock is yellow sandstone; and granite occurs at a distance of forty feet from the reef.

"The Haphazard Reef—only opened on the surface—is four feet in width, and has yielded 19 dwts. per ton. Arsenical pyrites occurs in the vein.

"The Bon Accord is from five inches to nine inches in width. It has yielded 1 oz. per ton. The bounding rock is hard grey slate, and pyrites occurs.

"The Birthday Vein varies in width from nine inches to four feet. It has been worked to a depth of ninety feet, and has yielded 1 oz. per ton. The veins are full of pyrites.

"The Bismark is from six to eighteen inches in width. It has yielded 18 dwts. per ton. Pyrites is found in the vein, and the bounding rock is soft yellow sandstone.

"At the Eureka Claim there are two large veins, each varying from four to twenty feet in width. The greatest depth of the workings is sixty feet. The upper reef yields $\frac{1}{2}$ oz. per ton, and the lower 5 dwts. The bounding rock is blue slate. The quartz is quite white, like loaf sugar, and very soft."

Mr. Kennan also gives the following descriptions of the Twist's Creek reefs:—

"The Excelsior varies in width from two feet to 240 feet, and has yielded $3\frac{1}{2}$ ozs. per ton. The vein contains pyrites equal to about five per cent. of the whole mass of the vein. The bounding rock is blue clay-slate.

"The Nonpareil has been worked to a depth of 120 feet below the crown of the hill. The width is from two feet to two feet six inches, and the yield per ton 1 oz. The bounding rock is blue nodular contorted slate, containing gold for several feet from the vein.

"The Homeward Bound is nine inches in width. It has been worked to a depth of 140 feet, and the yield is from 2 to $2\frac{1}{2}$ ozs. per ton. The vein occurs between grey sandstone and blue rubbly shale.

"The United Reef has a width of two feet. It has been penetrated to a depth of 100 feet, and has yielded 2 ozs. per ton. The rock in which the vein occurs is blue slate, separating into rubbly masses.

"All the veins contain more or less pyritous minerals. The gold is generally evenly distributed throughout the mass of the vein-stone, and rich specimens are comparatively rare."

From returns made by the same gentleman, it appears that 1,883 tons of quartz, taken from the Hillsborough reefs, gave 13 dwts. 18.20 grs. per ton; and 2,037 tons from the same place 1 oz. 1 dwt. 17.47 grs. per ton. Much of this quartz was got at depths exceeding 160 feet. Other reefs in the same locality present nearly similar features.

Mr. Butler states, in his report for December, 1867, that a vein has been struck at Hillsborough, which has yielded at the rate of 4 ozs. per ton.

The reefs in the neighborhood of Indigo and Blackdog Creek are numerous; but few of them have yet been opened. There is a general belief in this locality that the veins are rich only near the surface; and though, in past times, some have yielded 4 ozs. per ton, and quite recently the Two-to-one Reef 7 ozs. 12 dwts. 16 grs. per ton from quartz taken out at a depth of 130 feet, and West's Reef at a depth of 100 feet a parcel of 906 tons 10 cwt., giving an average of 8 dwts. 8 grs., they are still almost neglected.

As a rule the veins are thin, and consequently are difficult to follow.

Some reefs at Baddaginnie have yielded as much as 3 ozs. per ton; but before the value of the quartz was discovered, great quantities of it had been used as metal on the main road from Sydney to Melbourne. The mines are situate about three miles west of Benalla, and six reefs have been discovered, the general bearing of which is N. 22° W. Specks of gold are visible in nearly every piece of quartz broken out of the veins. One ton yielded 3 ozs. 15 dwts. 20 grs., and, it is said, the stone was a fair sample of the reef.* Very little has been done towards developing these reefs.

* *Mining Surveyors' Reports*, page 212 and page 323, vol. III.

On the Ovens River, and on its tributaries the Buckland River, Morse's Creek, and Growler's Creek, there is a large number of valuable reefs.

More than 529 veins have already been prospected in the district of Beechworth, and at the present time they give employment to 2,293 quartz miners.

The Alta Reef at Buckland, when first opened, yielded 13 ozs. per ton, and the average for some time was 1 oz. 5 dwts. per ton. The vein is in some places only ten inches in thickness.

The Oriental, the Pioneer, and Cockney Reefs, at Morse's Creek, have yielded from some parcels of stone as much as 3 ozs. per ton. From a bucket of stone broken out of the cap of the Pioneer Reef 16 ozs. of gold were got, and 824 tons from the Oriental Reef gave 4 ozs. per ton. Another parcel of 120 tons gave an average of 1 oz. 10 dwts.; another of 24 tons, 1 oz. 10 dwts.; and another of 14 tons, 7 ozs. 5 dwts. per ton. At Mead's Reef, Morse's Creek, 95 tons yielded 3 ozs. per ton.

Gander's Reef, Growler's Creek, gave $4\frac{1}{2}$ ozs. per ton from a large parcel of stone, and the Elgin Reef, at the same place, yielded 2,729 ozs. of gold from a crushing of only 210 tons.*

Instances of a similar kind might be multiplied. Having regard to the facilities for working these veins economically, for crushing the quartz and for procuring timber, it is not surprising that claims are eagerly sought after. The veins crop out on the summits of very steep ranges; they can be easily reached by tunnels, and water is nearly everywhere available as a motive-power.

Mr. A. C. Wills, the warden at Bright, says, in his report for December, 1867, in reference to the quartz reefs in his district:—"The great wants of the district are capital and cheaper European labor and cheaper provisions. All look forward to the completion, before 1870, of a railway from the Echuca line to Wangaratta, which latter town is only one day's drive from Bright. If that were completed many Melbourne capitalists would probably visit this district: those who have already invested in the quartz reefs have had no reason to regret their ventures."

Mr. L. C. Kinchela, in his report for the quarter ending the 31st March, 1866, mentions the numerous, almost daily, discoveries of reefs in the Main Dividing Range between Harrierville and the Dargo. He has personally inspected some of them, and made diligent enquiries respecting all hitherto found, and he believes that the country lying between Harrierville and the Dargo will be of the highest importance, as a reefing district.

The older reefs have been well prospected, and there is no doubt as to the permanence and value of them. In the Shamrock, Rose, and Thistle Reef, stone yielding three ounces per ton has been struck at a depth of 400 feet; and a new reef has been found in the 1,500 feet tunnel, driven for the Pioneer Reef, the new vein being 350 feet below the cap of the Pioneer.

The following account of the discovery of gold at Wood's Point, and description of the reefs in that locality, have been compiled by Mr. A. B. Ainsworth, mining surveyor and registrar; and they give evidence of so much care in the preparation that it is just to give the paper exactly as it was furnished:—

"About twelve years ago Messrs. McDougal (Duncan and Colin) came up the Goulburn to Jamieson. They had with them a dray and a plentiful supply of provisions and tools; but the prospects obtained were not such as could induce the alluvial miner to settle to work in the days following Golden Gully and Fryer's Creek.

* *Mining Surveyors' Reports*, pages 113 and 114, vol. II.

"They were succeeded, in 1859, by prospecting parties pushing up from Reedy Creek to the Big River first, and subsequently to Jamieson. Thence they gradually found their way through the thick timber and scrub, with tomahawk and firestick, along the Goulburn to Clarke's Point (opposite the junction of Stander's Creek), which spot they reached in May, 1861. A year previous to this Gaffney was working a claim at the foot of the Flourbag, on the Goulburn, and had brought a water-race from Gaffney's Creek, as it was then called.

"A Welshman, Tom Jones I believe, subsequently prospected this creek; and about the same time that the alluvial miners, following the course of the river upwards, reached Clarke's Point, two miners of a bolder and more enterprising disposition, faced the scrub and precipitous ranges around Gaffney's Creek, and crossing the Divide dropped into the mountain gorge, now the site of Wood's Point.

"These men, who first explored the right and left branches of the Goulburn River, from their junction, were also the discoverers of rich alluvial deposits and of the Morning Star Dyke and Reefs.

"Mr. Dittmer Behrens, a native of Schleswig-Holstein, had not been many months in Victoria when he found himself opening alluvial ground near the junction of the right and left branches of the Goulburn. Possessing great natural sagacity and self-reliance, and with a fine constitution, inured, though young, to privations and exposure, he crowned a life rich in startling adventures by finding a fortune in the Morning Star Reefs.

"Mr. Joseph Corry, his companion, had had longer experience as a miner. On the third day of their arrival they separated—Corry to prospect the right, Behrens the left branch. It was in taking a short cut across the spur, running into the junction, to rejoin his mate, that, towards the evening, Corry's attention was arrested by some quartz strewn on the surface, all of which showed much gold.

"On the following day they proceeded to mark out a large area of ground, which was subsequently reduced to the present prospecting claim.

"The difficulties which they had to encounter in the way of obtaining food, and subsequently erecting machinery, can only be understood by those who have known this or similar goldfields in their early stages of development. They were, of course, soon followed by other miners; and an itinerant storekeeper—a now well-known shareholder in one of the Morning Star claims, and lately a councillor of the Wood's Point Municipality—brought up a pack cargo of flour, &c., along the saddle of the range from Gaffney's Creek to the top of Clarke's Spur, now known as Cherry's Point. Flour was sold at £11 sterling a bag, and other provisions in proportion. That friendly feeling which existed so universally between mates in the early days of gold hunting, induced Colin McDougal to join his old companions at Wood's Point, and he then obtained a share in the Morning Star Prospecting Claim.

"A trial crushing with a dolly gave 33 ozs. to 15 cwt. of stone, and McDougal was despatched to Melbourne to endeavor to get machinery constructed, the heaviest piece of which was not to exceed 200 lbs. in weight, as this was considered the greatest weight a horse could carry over the ranges. Money was, in the meanwhile, obtained by working the alluviums; and the necessary races for the water-wheel were cut by the partners themselves. Packers refused to load the iron. They were, therefore, compelled to pack up the ironwork for their eight-stamper machine themselves. This, though probably not exceeding three tons, took three months to bring from Jamieson, and a little more than one year elapsed (August, 1862) before the first crushing took place on the Morning Star. The machine was then of the roughest description, the

stampers being square with wooden shanks, the boxes made of several pieces, and the heaviest part—the pinion-wheel—weighing only 220 lbs. A source of continual expense and anxiety was the nature and steepness of the hillside, along which the first race was cut. The peculiar hard blocks of granite strewn about on the surface, the numerous wombat holes or rather caverns worked far into the soft granite, which caused the water to break frequently away, caused serious landslips which endangered the foundations of the machine.

“When the gold was obtained it had to be hidden in some *cache* in the scrub, whence at midnight the owners would load some 2,000 ounces on their backs, and carry it stealthily by moonlight up the steep spurs, reaching, early in the morning, some shanty, where a horse was ready to carry it to Jamieson. It need hardly be said that a population of the very wildest description had followed on the footsteps of the various prospecting parties, and that the mountain fastnesses served as hiding places to many outcasts of society, to whom, however, the abundance of money and general prosperity left little inducement to crime.

“The Colonial Bank of Australasia established an agency early in 1863. There was then a population of not less than 400 or 500 on and immediately around the present site of Wood’s Point; yet so little was the place known in Melbourne, that when, in September, 1863, having been induced to undertake some surveys for the Department of Lands and Survey, I was gleaning information regarding Wood’s Point, the only item of news I obtained was that a man named Wood had a canvas house, believed to be the only one there, and that the place was buried in snow eight months in the year. At that time Wood’s Point and the district added a monthly contribution of certainly not less than 4,000 ounces of gold to the wealth of the colony.

“The claims taken up on the Morning Star Dyke, adjoining the prospectors, which have since become known by their rich yields, were those known as Scott and Cherry’s, the Age of Progress, the Wood’s Point Company’s, the Alps Great Central, and the Hope Company’s.

“The alluvial miners had, in the meanwhile, taken up the Goulburn as far as the All Nations on the left branch, and the Maori Creek on the right. They had been very successful, obtaining as high as 50 ozs. to the paddock, twelve feet square. The tributaries, especially Gooley’s Creek, gave rich returns also to the claimholders, and gold was very plentiful at ‘the Point,’ though money and notes could hardly be obtained; all transactions being necessarily carried on as barter with gold dust.

“The success of the Morning Star prospectors, and the fact that the whole available alluvial, confined, as it is, to the beds of the creeks, had been taken up, caused the attention of miners and a few old hands to be directed to prospecting for reefs. Their efforts resulted successfully in the discovery of the All Nations, the Never-mind, and lastly the Royal Standard, and many others of less note; the first by Frederick Stander, the second by Henry Matthews, and the last by William Singleton. The successful prospectors referred to were all men used to the ranges, who had come up in the van of the gold seekers.

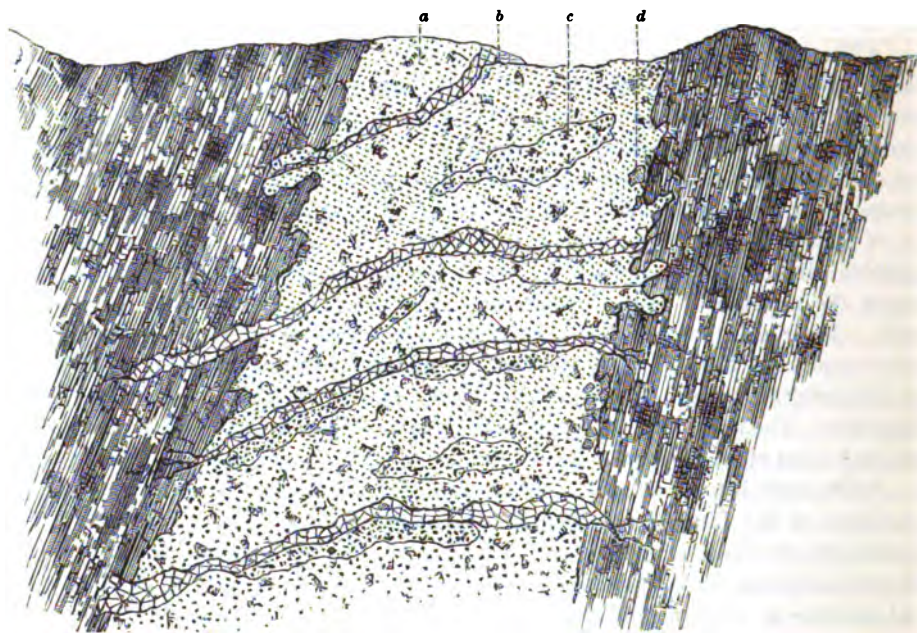
“The introduction of scrip, due to the desire to take advantage of some of the provisions of the Limited Liability Act, increased the tendency to over-speculation, already rife in the district in 1864. The reaction has been severe, but it is matter for congratulation for all persons having the welfare of the district at heart, that the real advance as a great mining locality, though somewhat retarded by the want of capital, has never received a check, and that its production of quartz gold is not only greater than ever, but also much greater than that of any like number of claims

crushing in any locality of the same extent in Victoria; and this, notwithstanding the heavier working expenses and larger outlay in machinery.

"Morning Star Reefs."—The Morning Star Dyke is a grey granite, large masses of which are decomposed, and are of an earthy brown hue and texture. Masses of syenite, also often decomposed, occur chiefly in the immediate vicinity of the quartz lodes. The strike of the dyke, or rather the centre line of surface intersections with the bounding slate rocks, is about 52° west of north. These lines of surface intersections with what are usually termed here the eastern and western slates, properly the north-east and south-west slates, converge from a width of nearly 200 yards, showing in the prospectors' claim to about thirty feet (the last section wrought) in the Rising Sun Claim, and thence no doubt to a point, in a distance of about 450 yards, of horizontal projection. The dyke here seems to dip into the spur to the north-west, but is supposed to rise to the surface again at the head of Ryan's Creek (El Dorado claim), to the north-west; and in the Camp Lease, and Heffernan's Shamrock, and Gooley's Creek, to the south-east.

"It is traversed by flat quartz-veins running across from slate to slate and dipping with the dyke to the north-west, and having a side dip towards both slates. These veins penetrate the slate walls, and are extremely rich near their junction, and for a distance of say twenty feet to thirty feet where they run out. Their thickness varies in the same reef in different places, and also in the different reefs which run parallel at distances from one another of from 16 to 100 feet. Five distinct lodes, at least, have been traced on the surface between the shafts of the Hope and the Alps Great Central and the prospectors' workings. These lodes vary in thickness from an inch to three feet, and attain, in one instance, a bulk of fifteen feet of payable stone, yielding, say, from 10 to 15 dwts. in the Age of Progress. A section along the spur north-east is given in Fig. 57.

FIG. 57.



CROSS SECTION OF MORNING STAR DYKE.

a Rotten granite, hard in places. b Quartz veins. c Syenite. d Masses of tough granite lying along slate.

"None of the workings in the reef have reached the permanent water-level. The tendency of the water in the dyke, however, is naturally to run with the dip of the quartz veins, i.e. north-west, and it is in the claims at this end only that the water has proved troublesome; again, the dyke itself was found dry above the water-level, and not until the junction of the slate and granite was cut by the Alps Central's first shaft did the water become troublesome. I give below data from the books of the most valuable claims on this line. The granite and syenite of the dyke are gold-bearing, and will no doubt eventually be crushed. At present only about six inches to a foot of the soft granite adjoining the veins is crushed. The quartz shows but little pyrites, but the syenite veins adjoining are full of it.

"*Statistics of Morning Star Prospecting Claim.*—The claim was taken up in May, 1861, under the bye-laws, but subsequently under lease, and, including the garden claim, the prospectors hold an area of eight acres one rood two perches.

"Their first crushing in August, 1862, produced £6,545 18s. They were after that idle until May, 1863, partly through want of water and partly through the necessity of constructing new races. The largest yield produced in ten days £40,000 of gold, when the stamps were found to be moving in a solid bed of amalgam.

	£	s.	d.
Dividends to July, 1865 (inclusive) - - - -	91,810	6	10
From July 31, 1865, to June 30, 1866 - -	22,554	8	9
For the month of July, 1866 - - - -	1,769	1	1
For the month of August, 1866 - - - -	1,579	1	11
For the month of September, 1866 - - -	1,374	15	4
For the month of October, 1866 - - - -	1,288	8	11
	£120,376	2	10
Machinery and working expenses - - -	44,065	6	1
Total produce of Mine, October 31, 1866 - -	£164,441	8	11

"The machinery consists of two water-wheels—one working eight, the other twelve stamps. The latter is a turbine-wheel, which cost, with requisite alterations to adapt it to the old batteries, £1,200. With a sufficient water supply it would drive thirty stamps. It has four ports and is fifteen and a-half inches in diameter, and the height of the water fall is fifty-five feet.

"The company hold two races and water-rights—one a mile and a-half in length, heading from the right branch (first right), under license, and the second about one mile, heading from the left branch, under the bye-laws.

"The company also hold half interest in a tramway three miles long running up the left branch, and supplying the Prospectors' and Scott and Cherry's claims with timber. This half interest cost £800.

"The aggregate length of tunnels in the claim, of which there are four, is 955 feet; and the aggregate depth of shaft and shoots, of which there are five, is 265 feet; and a winze ninety-five feet from the lower reef has been raised.

"The gold produced is of 18·2 carats on an average.

"*Nos. 1 and 2 North Gold Mining Company, Morning Star (Late Scott and Cherry's).*—The claim was taken up in January, 1862, under the bye-laws, but is now held under lease. Its area is five acres twenty-four perches.

"The first crushing took place at the prospectors' machine, in June, 1863, the yield being 851 ozs. of gold.

"The largest crushing or yield was obtained for ten days crushing to 5th December, 1865, and produced 1,424 ozs. 7 dwts. of gold from fifteen stamps.

"The total yield of this mine, to October 31st, 1866, was 40,400 ozs. of gold.

"The gold produced is of 18.50 carats.

	£
The total cost of working, to July, 1865, was - - -	30,450
To date (from July, 1865) - - - - -	13,300
Total working expenses - - - - -	43,750
Cost of machinery - - - - -	7,000
Absolute working expenses - - - - -	£36,750

"This amount includes £9,036 paid to prospectors for crushing, previous to the erection of the machinery.

"The company have a water-wheel (fifteen horse) and a steam engine of twelve horse-power, driving four batteries of five stamps each; and connected therewith they have a stone-breaker (hydraulic) sufficient to supply broken stone to double the number of batteries at least.

"They hold half the tramway referred to under the prospecting claim, and have another tramway from the mouth of their tunnel 500 yards in length.

"They have also a water-race about 500 yards in length.

"Their tunnel is 570 feet long, opening into 900 feet of main drives; and they have three shafts, of the aggregate length of 460 feet.

"*The Hope Gold Mining Company.*—This claim, now under lease, was taken up in April, 1862, and its area under lease is four acres twenty-two perches.

"The first crushing, of 85 tons (July, 1863), gave £873 3s. 3d.

"The largest crushing was a fortnight's crushing, ending on the 13th October, 1866, which gave 807 ozs. of gold from fifteen stampers.

"The assay of this gold is 18.80 carats.

	£	s.	d.
The total yield of this ground, to date, is - - -	40,654	3	1
The outlay in wages - - - - -	14,611	2	2
Powder and working materials - - - - -	8,152	0	5
Total working expenses - - - - -	£22,763	2	7
Cost of machinery - - - - -	6,122	14	3
Race—800 yards - - - - -	325	0	7
Tramway, hopper, &c. - - - - -	145	10	0
	£6,593	4	10

"They have a tunnel 800 feet long, and a shaft 360 feet, and about 400 feet of main drives.

"This company has the most complete plant in these ranges. Their driving power consists of a thirty-five feet water-wheel, or, as an alternative, a twelve horse-power engine; and they have three batteries of five stamps each, with a double set of tables (the boxes delivering backwards and forwards). The batteries are self-feeding, and, owing to the rubbly nature of the stone crushed, work very well, though not provided with a stone-breaker.

"The claim may be said to be only just in fair working order, and the machinery has not been completed more than five months.

"The working expenses for the last fortnight were £458 9s. 9d., against a yield of over £2,028 (the assay not being yet in). This return is not included in the previous ones.

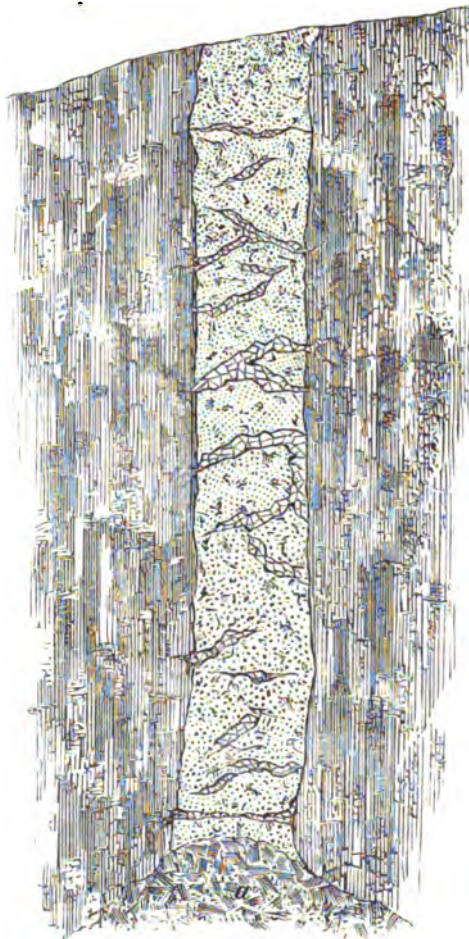
"*The Waverly*.—The Waverly is noticeable as the best defined dyke of its kind in the district.

"It is a granitoid dyke running with the strike of the slate about N. 52° W., for a distance of a mile and a-half. It has two well-defined parallel slate walls about three feet six inches apart, and on an average a dip of nearly 90°, varying in bearing with the undulations of the surface it crosses. The rock is rotten and the sinking very easy. It is traversed horizontally by bands of quartz, varying from an inch to two feet in thickness; and from some of these bands stone has been taken equal in richness to anything in the district. Trial crushings made of late along the line have yielded from 12 dwts. to 2 ozs. per ton.

"A feature peculiar, though not singular, as regards these mullock reefs is the hard greenstone that cuts off the lode along the whole dyke at depths varying from 70 to 200 feet in the various shafts, sunk from the prospecting claim southward along the whole line, and northward as far as No. 4 North. There is no doubt that this greenstone runs along the whole series of northern claims, since it reaches the surface in what was formerly No. 13 North; but the works have not been pushed deep enough to strike it in this direction.

"The value of this dyke as a payable lode is not open to doubt, seeing that some thirty shafts have been sunk on it, and payable prospects very generally obtained. It is easy to work, and machinery will in all probability be erected on it.

FIG. 58.



CROSS SECTION OF WAVERLY DYKE.

a Greenstone.

"All efforts made to penetrate the crystalline rock above referred to have been abandoned on account of the expense, sinking or driving costing from £5 to £12 per foot.

"Gold is found in small quartz-veins running through this rock in the same manner as in the soft superstratum, evidently originally the same substance.

"A large reef, barren so far as prospected, has been found some forty feet to the south-east of this dyke, and running parallel thereto.

"The mullock of the Waverly Dyke has produced rubies, and is itself auriferous. The gold is of high quality. Fig. 58 represents a section of the dyke.

"*The Never-Mind Prospecting Gold Mining Company.*—This mine is considered to be a mullock reef, but there is not yet sufficient evidence available to determine its character.

"It was discovered in 1864, by Henry Matthews and partners.

"The company has now sixteen stamps at work, but only within the last six weeks. Previous to this there were eight stamps only.

"The yields from this mine have been very steady.

"The first crushing took place in December, 1865, and produced 244 ozs. of retorted gold.

"The largest yield obtained was 424 ozs. during the current year.

"The total yield to November 10th, was 4,000 ozs. 16 dwts.

"The average assay was over 22 carats.

"*The Royal Standard Reef.*—The last great discovery in this district was the Royal Standard Reef, which was made by William Singleton; his mate, Frederick Stander, being absent when the fortunate finder came across the reef.

"The district which this discovery opened up has not yet realized the expectations, I think, justly entertained; and with the exception of the prospecting claim itself, the ventures entered into have not shown as yet satisfactory results. It is, nevertheless, pretty certain that it will afford instances of success, second only to those of the premier claim itself, in despite of the ill-will and prejudiced opinions of those who, through ignorance, mismanagement, reckless expenditure, or over-sanguine expectations, have met with temporary losses. For my part, I have the greatest confidence in this part of the district.

"The Royal Standard Reef crops out for about twenty yards along a spur running from Mount Singleton to the junction of Stander's and Chandler's Creeks, in a north-westerly direction. The spur is about three miles long, and very steep on both falls.

"The reef itself runs in with the slate, and throws out great arms or leaders chiefly northward. One of these leaders, and a part of the main reef, is now being worked, and it varies in thickness from two feet to twelve.

"The strike of the main body follows, so far as yet ascertained, the strike of the slate, and dips to the northward, while the main leader now being worked cuts across the slate obliquely, rising also to the southward and dipping with the spur. There remains little doubt but that the lode itself runs through the North No. 1 Claim, from the prospectors' workings, and it is to be hoped that the lead of gold will be found there also.

"A skid shaft is being sunk, and a drive put in from the main tunnel, which will give a working level for ninety feet vertical of reef in the heavy leader above mentioned. As the mine shows at present, a twelvemonth of work or more is bared to view, should the lode be all crushed.

"The lowest level—that of the main tunnel—yet driven will be about 500 feet above the permanent water-level in the spur, and it would be difficult therefore to say what length of time it will take to work out the reef.

"The amount of work done in the claim is confined to a section of ground, bounded below by a level seventy feet from the ridge of the spur. This section, however, is far from being worked out; and, as stated above, a skid shaft following down the main leader is now being sunk to a level ninety feet vertical below the third or seventy feet level.

"A very large mass of stone is to be seen in the workings, and, as will be expected, it is not all of the same or even all apparently of good quality. The value of the mine as a property is best appreciated perhaps by presenting the fact, that five months' crushings enabled the company to clear all expenses and pay dividends in the aggregate above the present quoted market value of their scrip.

"The machinery consists of a water-wheel driving fifteen stamps, to which is now being added an auxiliary steam engine.

"The first crushing took place in June, 1866 (it was retorted with the second, I cannot therefore give the yield). The highest yield obtained for less than a fortnight's crushing was over 2,000 ozs.; the lowest 681 ozs., and that for the week ending November 9th, 873 ozs.

"The total yield to that of the 9th November, inclusive, was 13,583 ozs. 16 dwts. of retorted gold; and the average assay was 23·08 carats, or, allowing one per cent. to reduce to standard gold, 13,718 ozs. of standard gold was the produce of this mine in less than five months' crushing with fifteen stamps.

"In conclusion, it is to be remarked that the district is entering a new phase in its working arrangements. The tribute system is rapidly extending, and it is the one, and the only one, under which a claim can be opened up economically here; and, under proper supervision, will not only afford in the long run a good criterion of its value, but also prove the quickest mode of maturing mining ventures in a district like this.

"The average cost, per foot, of sinking (slabbing included, where necessary), and all tools and timber provided by contractors, is as follows:—

	£	s.	d.
First 100 feet - - - - -	1	15	0
Second 100 feet - - - - -	2	5	0
Third 100 feet - - - - -	3	0	0

"The average cost of driving main levels, six feet six inches in the clear, four feet six inches at bottom, three feet at top, timbered where required, and after the first 100 feet laid with 3 x 4 rails and truck provided, is as follows:—

	£	s.	d.
First 100 feet - - - - -	1	5	0
Second 100 feet - - - - -	2	0	0
Third 100 feet - - - - -	2	5	0

"Three or four sets at the entrance, and a few sets occasionally when passing through soft strata, are what are used in our tunnels as a rule.

"The wages paid to miners are not uniform throughout the district. Since the alterations on the Morning Star claims, the average miners' wages, exclusive of overseers and others, is £3 5s. per week, but £3 10s. is still paid in many claims, and £3 at Wood's Point. Laborers' wages are about the same, unless hired for any length of time.

"The cost of machinery erected on the ground, per horse-power (steam), has varied in this district from £200 to £600. The latter was the cost of the Hope Company's machine.

"The Hope race, 800 yards long, cost £325 os. 7d.

"Tramways are worth £350 per mile, or 5s. 6d. per yard for short distances.

"I am not in a position to give the details of the Hope Company's machinery, as the engineer is not at Wood's Point just now.

"The largest water-wheel is thirty-five feet diameter, with shaft of wrought iron eight inches thick.

"The smallest turbine is fifteen inches, with three ports driving twenty stamps."

Alexandra is situate on the northern bank of the River Goulburn, near the points where the River Acheron, and the Eglinton and U. T. Creeks unite with the main stream. There are numerous thin but very rich quartz veins cropping out on nearly all the ranges, and some of them have been wrought with profitable results.

Captain Couchman, the chief mining surveyor, has inspected this district, and has furnished a very elaborate report on it. Much of the country in the immediate vicinity of Alexandra is described by him as undulating, with comparatively low grassy ranges and broad gullies and flats timbered with red gum, and covered with good loamy soil suitable for cultivation. The appearance of the whole country around differs much from the older goldfields, except at the heads of the creeks. The hills have a smooth well grassed surface, and reddish clay soils predominate.

The rocks in which the veins occur are of the upper silurian age, and nearly resemble those of the Anderson's Creek Division, in the basin of the Yarra.

The Luckie Reef yielded 4,843 ozs. of gold from 978 tons of stone, or an average of 4 ozs. 19 dwts. 1 gr. nearly per ton; and the Eglinton Reef gave 65 ozs. 19 dwts. from 38 tons, and 29 ozs. 14 dwts. from five tons. Some small parcels from the Luckie Reef have given as high as 17 ozs. per ton.

The reefs, like some of those in the basin of the Yarra, are very thin, varying from one inch to one foot six inches. Numerous fine threads of quartz run through the bounding rocks in every direction, and in places isolated masses of quartz are found; but thick persistent reefs are the exception.

Near Mairdample, east of Hunter's Creek, there are several auriferous reefs, which appear to resemble in their physical character those north of Alexandra.

Numerous prospecting parties are engaged in examining this country, and there is a reasonable probability that many miners will find profitable employment both in the reefs and in the alluviums. It is questionable, however, whether any part of it will equal in importance the goldfields which have been opened towards the north-east and east.

The country between Alexandra and the Broken River, however, has been but imperfectly explored by the miner, and it would be rash to state that the general character of the reefs will resemble what is found at Alexandra.

The Mining District of Castlemaine comprises within its area many localities which are highly interesting to those engaged in quartz mining. Near the town there are many good reefs, and at Maldon, Fryer's Creek, Daylesford, Taradale, and Anderson's Creek, there occurs nearly every variety of vein, from those as thin as paper where the gold is in nearly the same proportion as the quartz, to wide dykes, traceable for long distances, in which it is scarcely possible to find gold by the naked eye.

The central part of the district, which includes the sources of the Rivers Loddon, Coliban, and Campaspe, is composed mostly of rocks of the lower silurian age, and that part lying to the eastward—the basin of the River Yarra—is occupied, mostly, by the upper silurian.

A small part of the district relatively is covered with basalt, and throughout the vast extent of exposed palæozoic rocks it is possible to find and to trace, without difficulty, innumerable quartz veins.

These facts should be borne in mind in considering the statements which have been furnished respecting the character, thickness, and yield of gold from the quartz veins, and in estimating the value and importance of the several districts.

Wattle Gully, Forest Creek, has been described as a "bed of gold mines." Auriferous quartz is found in the gully for a width of 1,200 feet, and some of the vein-stone has yielded in large parcels as high as 12 ozs. per ton. One parcel of 2 tons gave 402 ozs.; a second parcel of 2 tons, 533 ozs.; and from half a bucket of specimens, 286 ozs. were obtained.

In one claim, the same vein from which these rich returns were got was struck at a depth of eighty feet, where it appeared to run out, but other veins were found; and below the water-level, quartz yielding 45 ozs. per ton was taken out, the gold being generally coarse, ounce nuggets, and even five-ounce pieces being found. Much of the other quartz was poor. Phillip's Reef gave from 9 to 12 ozs. per ton. The Cumberland, Little Nuggety, Bolivia, the Old Post Office, Shank's, Crocodile, Mona, Monk's, Eureka, Victoria, Manchester, Poverty, Moonlight, Capper's, and Sebastopol reefs, together with a great number of others, have from time to time been opened, and some of them have given more than 10 ozs. per ton; but notwithstanding the good prospects, quartz mining has not been extensively followed, nor energetically prosecuted, in the neighborhood of Castlemaine.

At present there are only 578 quartz miners in the Castlemaine Division; and no more than 26 steam quartz crushing machines, driving 240 stamps.

A thorough investigation of these reefs should be made, in order to ascertain the causes which have led in so many instances to their being abandoned. Three, or four, or five pennyweights of gold per ton, under circumstances which would admit of the quartz being got out at a small cost, would well remunerate the miner; and yet here is a division with numerous rich veins in every part of it lying almost neglected.

An account of the operations of some of the more prominent quartz mining companies at Castlemaine, would throw some light on this question; but no good results would follow from investigations into their origin and management. By-and-by persons, taking advantage of the example set by the Port Phillip Company at Clunes, will examine the Castlemaine reefs, and bring back that state of prosperity which it once enjoyed.

The following brief account of some of the reefs at Maldon, compiled by Mr. Nankivell, mining surveyor, is valuable:—

"Alliance Company, Nuggety Reef.—This company has a lease from the Crown, and holds the following old claims, viz., Crystal's, Miller and Co.'s, Enterprise Co.'s, and Walker and Co.'s; the former having been the richest claim ever hitherto discovered and worked in Maldon. It is only thirty-nine feet three inches in length, and it proved very rich to a depth of 280 feet, 45,000 ozs. of gold having been taken therefrom. One ton and three-quarters of quartz yielded no less than 560 ozs. of gold. The average thickness of the lode taken out is about twelve feet; at the depth named the yield fell off considerably, and the lode increased from twelve to thirty feet

in thickness. The proprietors of the Alliance Company have sunk to a depth of 420 feet, but the lode continues poor and is of the same thickness. With respect to the other claims which have been merged in the company, the yields were also very large—from Walker and Co.'s Claim 225 ozs. were obtained from about 1 ton of quartz, and from the Enterprise Co.'s the yield was very large.

"Grand Junction Company, Lisle's Reef, Mount Tarrangower.—The celebrated claim of Doctor Lisle, Lisle's Reef, Mount Tarrangower, now forming a part of the Grand Junction Company's lease from the Crown, was very rich when first discovered and worked. During a period of about ten months from the date of discovery, £34,000 worth of gold was taken from the claim and divided between Dr. Lisle and his partner, a man named Napier, after paying all expenses. This mine was worked to a depth of ninety feet, and the lode averaged only about two feet and a-half in thickness. Several other claims on the same reef, which were merged in the Grand Junction Company's lease, viz., Mounhsen's, Darby's, Foggart's, and the Cambridgeshire Men's, and which were all worked by private parties, including Lisle's Claim, yielded in less than twelve months 20,000 ozs. of gold, being equal in value to about £80,000 sterling. Manton's Reef, lower down the valley than Lisle's about 400 yards, is also included in the Grand Junction's lease, which was obtained about six years ago.

"Beehive Company, Beehive Reef.—This company's mine has been a very productive one. Since its formation, six years ago, the value of gold taken therefrom amounted to £103,321 12s. 3d. Previous to the formation of the company, however, a very large quantity of the precious metal was secured from the same reef by private miners; though of the amount procured in that way it would now be almost impossible to arrive at anything like a correct estimate (£30,000 may safely be put down as being within the mark). When the reef was first worked the yield averaged from 3 and 4 ozs. per ton in one place, to a depth of twenty feet from the surface, so that the quantity of gold obtained must have been very large from that particular place alone.

"Great Western Company, Beehive Reef.—Until within the last four years this company was merely a quartz crushing concern; since that period, however, the company ceased to crush for the public, and became a quartz mining company, under a lease from the Crown. The mine is one of the richest in Maldon, if not actually the very best in operation at present. The average yield is from $1\frac{1}{2}$ to 2 ozs. per ton. Thickness of reef four to five feet.

"Eaglehawk Mining Association.—Previous to the formation of this company, which comprises a number of old claims, the Eaglehawk Reef was very rich in gold. In one patch a single ton yielded 500 ozs., which was got by Crisp and Co., and from 40 to 100 ozs. per ton was obtained. The reef is still good, though by no means so productive as it once was.

"Union Company, Eaglehawk.—This company was formed about seven years ago, and holds several old and very rich claims. The mine is at present worked on tribute by Messrs. White and Co. For twelve months the yield was exceedingly good, averaging somewhere about 6 ozs. to the ton, taking the quartz as it came, varying from five to fourteen feet in thickness. Recently, however, the lode was suddenly cut off by a bluestone dyke. The reef has again been found but not yet opened up. The depth of shaft is 320 feet, and the width of reef varies from four to fifteen feet.

"Derby Company, Victoria Reef.—The Derby Company was organized about two years ago, and includes several old claims. It is a private company, the ground is easily worked, and very profitable in consequence, though the yield of gold is only

from 1 to $1\frac{1}{2}$ oz. per ton. The depth of shaft is 310 feet, and the reef varies from four to eight feet in thickness.

"Pioneer Company, Wilson's Reef."—The Pioneer Company, Wilson's Reef, commenced operations some four years ago. It was for a considerable time afterwards unprofitable, but within the past twelve months the character of the mine has been re-established, and the prospects for the future look well. During the period referred to the yield has very much improved, and now averages between 3 and 4 ozs. per ton. The depth of shaft is 300 feet, and thickness of reef four feet.

"There is a number of other quartz claims and companies in the division of Maldon, many of which are doing very well and yielding handsome returns to the owners and shareholders; but those already enumerated are amongst the principal now in operation.

"Herewith is a separate statement of them, headed and divided into columns, with the various particulars asked for. The estimates of gold date from the commencement, and I believe are rather under than over the amounts obtained."*

* Additional information, contained in notes attached to a map and sections of this goldfield, recently prepared by Mr. Geo. H. F. Ulrich, F.G.S., and Mr. H. Y. L. Brown, is appended hereto:—

"Fentiman's Reef."—In several of the claims worked on this reef lenticular patches and narrow veins of sulphide of antimony, coated with antimonial oxyd, have been found associated with the gold. Specimens of the sulphide, on being broken, often show narrow cracks coated with modified crystals of native sulphur.

"Swipers' Reef" is formed at the outcrop of a number of strong quartz veins which have yielded very fair returns of gold. In Mr. Fordred's claim, at about forty feet from the surface, fine tabular crystals of sulphate of baryta (heavy spar) have been found coating cracks and hollows in rather poor quartz.

"Jackson's Reef" consists of a dense white felspathic dyke, intersected at the outcrop by numerous auriferous quartz veins. These veins have gradually disappeared in depth, and the reef has, therefore, been abandoned.

"Victoria Reef" is principally worked by the Derby Company. During the last two years £30,000 worth of gold has been obtained by this company from workings extending to a depth of 310 feet. The quartz yielded, on the average, 1 to $1\frac{1}{2}$ oz. of gold per ton. The reef is from four to eight feet thick, and becomes gradually richer in pyrites in depth. Its western wall consists, for some distance, of a dense white felspathic dyke. The strike of the reef is N. 10° to 12° W., with a westerly dip of 80° to 85° .

"Lennox's Reef."—This reef dips E. 14° S. 70° . A small patch of auriferous quartz was found at the surface, and at eighteen feet in depth the quartz yielded about 2 ozs. per ton; but from thence became too poor for working. The hard bluish-grey metamorphic sandstone, which forms the walls of the reef, contains numerous joints and cracks with drusy coatings of heulandite and dolomite, and fine obtuse rhombohedrons of yellow calcite.

"Manton's Reef."—Strike, N. 14° E., with a vertical dip. The principal workings on this reef are those of the Grand Junction Company, which extend to a depth of about 185 feet, and have produced, during six years, £60,000 worth of gold. The reef is from two to six feet thick, and the average returns are $2\frac{1}{2}$ ozs.; some have been as high as 5 ozs. of gold per ton of quartz. At lower levels the quartz becomes more and more strongly impregnated with iron and arsenical pyrites.

"Parkin's Reef" dips W. 12° S. 76° . Thickness, ten to fourteen feet. At one place it has been taken out bodily to a depth of 140 feet, and for a considerable length. The yields have ranged from $\frac{1}{2}$ to over 16 ozs. of gold per ton. At 180 feet in depth, where its thickness exceeded thirty feet, it became suddenly very poor, and has continued so down to 230 feet, the greatest depth yet worked, and where only traces of gold have been found. Small veins and mammillary crusts of black ferro-manganese ore are very abundant in some parts of the outcrop of the reef.

"The Beehive Reef."—This celebrated reef, one of the richest and most extensive of the Tarrangower Goldfield, strikes N. 18° to 20° W., with a westerly dip of 70° to 80° , and in some places is nearly vertical. Its northernmost surface outcrop is on the lease of the Beehive

"A STATEMENT OF OPERATIONS, AND PARTICULARS RELATING TO SOME OF THE
MOST PRODUCTIVE MINES IN MALDON."

Names of Mines or Companies.	Total quantity of Gold obtained.	Rise of Claims.	Length of Time at Work.	Thickness and Character of Reefs.	Description of Machinery.	Number of Stampers.	Depth of Shafts.	Number of Men employed.	Manner of Working.	Number of Lease.
	£	A. R. P.	Years.	Quartz— Feet thick.			Feet.			
Alliance Company, Nuggety Reef	200,000	6 0 38	12	12 to 30	Steam engine	Nil	420	23	Sinking and Stoping	186
Beehive Company, Beehive Reef, Mal- don	105,000	12 1 31	6	12 to 15	Steam engine	20	300	80	"	155 and 171
Eaglehawk Associa- tion, Eaglehawk Reef	135,000	14 3 2	7	3, 4, and 12	Steam engine and 4 Chilian mills	24	260	32	"	107 and 125
Grand Junction, Man- ton's Reef	60,000	10 0 0	6	2 to 6	Pumping and winding engine	Nil	185 140	34	"	{ 130, 140, 174, and 238
Grand Junction, Lisle's Reef	40,000	12 1 10	6	about 2						
Great Western Com- pany, Beehive Reef	80,000	5 1 12	4	4 to 5	Steam engine	16	260	34	"	170
Derby Company, Vic- toria Reef	30,000	2 0 18	2	4 to 8	Steam engine	Nil	310	30	"	283
Pioneer Company, Wilson's Reef	100,000	12 3 1	3	4	2 whims	Nil	300	30	"	275
Union Company, Eaglehawk	150,000	7 0 0	7	4 to 15	Engine and 6 revolving mills	18	320	42	"	131
German Reef Com- pany, German Reef	30,000	4 3 3	3	4	2 whims	Nil	140	8	"	253 "

A praiseworthy attempt to develop the reefs which lie adjacent to Mount Tarrangower is now being made. A tunnel has been commenced which it is expected will cut a great number of reefs at right angles to its course, and enable the projectors to work these by stopes.

Company. At several points on its southern extension it has been faulted, at one place to the extent of half a chain, by fissures filled with soft clayey matter. The northern portion, called especially the 'Beehive Reef,' is worked by several public and private companies, viz., the Northern Beehive Company, the Great Western Company, Polsue and Vivian, &c., &c. In the lease of the Beehive Company the reef is from twelve to fifteen feet thick, and the yields since the formation of the company, six years ago, have amounted to £103,321 worth of gold. The workings extend to a depth of about 300 feet, and the quartz below the water-level is very strongly impregnated with iron and arsenical pyrites, and to a less degree with galena. Previous to the formation of the company large yields of gold had been obtained from the reef; at one place, for a depth of twenty feet from the surface, the quartz paid 300 to 400 ozs. of gold to the ton. In the ground of the Great Western Company the reef is from four to five feet thick, and has yielded about £80,000 worth of gold in four years, the quartz averaging $1\frac{1}{2}$ to 2 ozs. to the ton. The deepest shaft on this claim, formerly owned by Isaacson and Clement, is about 260 feet. At, and for some distance below the surface, drusy coatings of fine green and reddish-brown pharmacosiderite have been found, generally associated with gold; arsenical and iron pyrites; also, though more rarely, groups of small crystals of scorodite, ochreous pale greenish crusts of earthy scorodite, and groups of small imperfect crystals of copperas. In the Tiverton Company's ground the reef is from fifteen to thirty feet thick, and has been worked with very satisfactory.

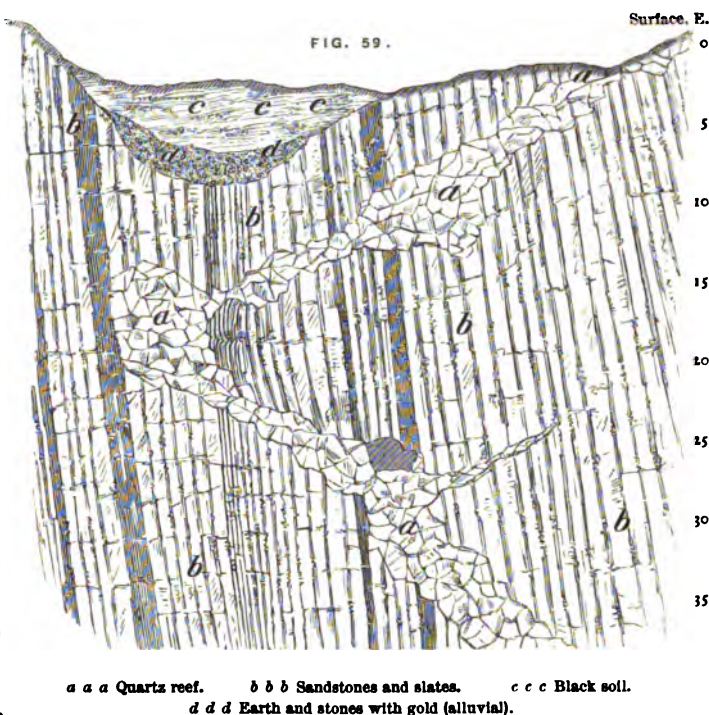
A great many exceedingly rich quartz reefs, some giving as much as 30 ozs. and 40 ozs. per ton, have been opened in the Fryer's Creek Division. The returns from many of them, however, have been very small. The manager of one company has stated that 3 dwts. per ton will pay very well in places where the quartz can be got at small depths.*

It was in this division and in Castlemaine that gold was discovered in the sandstone rock. It occurs in quite a different way from that got at Kamarooka. In the sandstone there are very thin veins and seams of quartz with gold, but at Kamarooka the metal is found in the planes of bedding of the rock.

At Bullock Reef, in the Fryer's Creek Division, 70 ozs. of gold were taken from crevices in the reef at a depth of 140 feet from the surface; and one lump weighing 14 ozs. 13 dwts., and another 12 ozs. 13 dwts., were found in the same vein.†

Fig. 59 shows a section of a reef

at Fryer's Creek, from whence a mass of quartz crystals, now in the National Museum, was taken. The crystals were found in the part shaded in the drawing. The reef consists entirely of milk-white quartz, and is auriferous, containing gold in quantities varying from 4 dwts. to 6 ozs. per ton. It has the appearance of being composed of distinct blocks of quartz piled one on the other; and the bounding rock—sandstone—is very hard, and of a yellowish-grey color. The crystals were embedded in clay, which, when dry, resembled fullers' earth.



results to the depth of 230 feet. The quartz, and the bluish-grey metamorphic sandstone forming its walls at this depth, are both impregnated with arsenical and magnetic pyrites; the latter sometimes appears in small indistinct crystals. The Pioneer Company, Wilson's Reef, obtained, in three years, £100,000 worth of gold; during the last year the quartz yielded an average of from 3 to 4 ozs. per ton. The reef is here four feet thick, and worked to a depth of 300 feet, the quartz becoming more and more strongly impregnated with iron and arsenical pyrites.

"The water collected from the lower levels of the Beehive mine is of considerable interest, on account of the excess of chloride of potassium over the other ingredients of the solid matter which it contains. It may ultimately prove of economic value as a source of potash, for, as is shown by

* *Mining Surveyors' Reports*, p. 286, vol. III.

† *Mining Surveyors' Reports*, September, 1864, p. 63.

At Daylesford and Hepburn there are several reefs of considerable extent and thickness, but comparatively little has been done to develop them.

Parker's Reef, New German Reef, and Old Nuggety Reef, and very many more, have from time to time engaged the attention of the miners; but practically very little has been done towards testing them properly. There are about eighty-five distinct reefs in this division, 457 quartz miners, and thirty-three quartz-crushing machines, driving 240 stamps.

In the Taradale Division there are several important groups of reefs, and also large areas intersected by auriferous veins which have not yet been prospected.

The Frenchman's Reef, about $2\frac{1}{2}$ miles south-south-west from Malmesbury, has been worked by tunnels, varying in length from 200 to 350 feet. About 100 feet of basalt and some twenty feet of alluvium overlie the bed-rock in which the vein occurs. The quartz is very ferruginous, and in some places twenty feet in thickness. Its strike is N. 18° W., and its dip slightly to the westward.

At the Barfold Ranges there are eight auriferous reefs. They have been wrought at various times, and rich yields have been obtained; but no systematic effort has been made to develop the main veins. Up to the present time the miners have worked only the smaller veins and off-shoots. The following yields have been reported:—

Tons.	ozs.	dwts.	Tons.	ozs.	dwts.
90 - - -	125	16	82 - - -	116	19
$15\frac{1}{2}$ - - -	20	5	$51\frac{1}{2}$ - - -	181	10
16 - - -	36	10	$211\frac{3}{4}$ - - -	226	8
5 - - -	3	3			

Or an average on $471\frac{3}{4}$ tons of 1 oz. 10 dwts. 3 grs. nearly.

At the Victoria Reef, 99 tons gave 98 ozs. 6 dwts.; and one parcel of $9\frac{1}{2}$ tons yielded 49 ozs.

According to information furnished by Mr. Archdall, it appears that the Old Kangaroo Reef, near Lauriston, occurs in the manner shown in Fig. 60.



In a paddock adjoining the Reserve at Lauriston, there are valuable quartz mines. Mr. Hugh Glass, on whose property they are situate, has caused the following particulars to be furnished by his agent.

the analysis made at the Geological Survey Laboratory, there would be but a small quantity of impurity to eliminate. The potash is no doubt derived from the granite which bounds, to a great extent, the silurian rocks in which the mine occurs, and the large quantity of granite *debris* in the vicinity shows that an immense amount of potash must have been, and probably is still being, liberated by the action of carbonated waters upon the felspars (chiefly orthoclase) and mica.

"The following is the analysis of the water:—It contains 139'361 grains of solid matter per gallon, or 1'99 parts in 1,000 of water. It contains some carbonic acid free.

Chloride of potassium	- - - - -	93'502	- - -	1'3357
" sodium	- - - - -	11'634	- - -	0'1662
Sulphate of soda	- - - - -	19'617	- - -	0'2802
Carbonate of magnesia	- - - - -	11'125	- - -	0'1589
Iron (Fe. o. Co.,?) alumina and phosphates	- - - - -	1'275	- - -	0'0182
Carbonate of lime	- - - - -	trace	- - -	—
Silica	- - - - -	2'208	- - -	0'0316
		<u>139'361</u>	- - -	<u>1'9908</u>

"J. C. NEWBERRY, Analyst."

The Nelson and Wellington Companies (amalgamated) have three shafts. No. 1 is 110 feet in depth; No. 2, 130 feet; and No. 3, 175 feet. The aggregate length of the drives and cross-cuts is 1,220 feet. The water-line is found at forty-five feet from the surface in No. 1 shaft, and at forty feet in No. 2 shaft.

In No. 1 shaft they have struck a vein six feet in thickness, with an underlie of 45° W. It is a white compact quartz with scarcely any pyrites in it; the gold is pure, and occurs in patches; and the average yield is 19 dwts. per ton.

In No. 2 shaft there are three parallel veins, each from four to six feet in thickness, and these are spread over a space of nearly ninety feet. The underlie is 45° W., and the quartz generally is free from pyrites; but there is a little sulphide of antimony in some places. The average yield is 8 dwts. per ton.

The character of the three veins in No. 3 is nearly the same as in No. 2 shaft, and they occur in the same way. The average yield is 4 dwts. per ton.

The General Wyndham and North General Wyndham Companies (amalgamated) have six shafts respectively of the following depths: 140 feet, 200 feet, 150 feet, and 80 (three). The total length of drives is 3,000 feet, with cross drives at different levels of 250 feet, and 180 feet east and west. The depth of the water-line varies from sixteen to twenty-eight feet.

In shafts No. 1 and No. 2 they have met with three parallel veins of quartz. In No. 1 shaft they are each twelve feet in thickness; they are found to unite in No. 2 shaft, where the total thickness is thirty feet; and thence the reef spreads towards the north, and has leaders varying from two to four feet in thickness.

In shafts No. 3, 4, 5, and 6 there is a mass of leaders spread over a thickness of eighty feet.

The underlie is 45° W.

The quartz contains small quantities of sulphide of antimony. In some parts of the veins the gold is very generally distributed through the quartz; in other parts it is in patches, and some of them so rich as to give 100 ozs. per ton.

The average yield is about 4 dwts. per ton.

A quantity of quartz taken from a vein, eight feet in thickness, which was cropping out on the General Wyndham Claim, gave 4 ozs. to the ton.

South and north of the lands held by these companies there are two other claims.

That to the south—the Abraham Lincoln Company—has a shaft 140 feet in depth. The vein is only four inches in thickness, but is very rich, yielding on an average 21 dwts. per ton.

The Glen-Gowar Company, whose claim lies to the north, has a tunnel 600 feet in length, and three shafts respectively 140 feet, 120 feet, and 80 feet in depth. No reef has been cut in the tunnel, though its course intersects the line of reef. Stone found on the surface yielded 15 dwts. per ton, and lower down a body of stone, eight feet in thickness, gave 3 dwts. per ton.

Whims are used on all the claims; and the crushing plants of the Nelson and Wellington Companies, and the General Wyndham and North General Wyndham, consist of two engines of twenty-five horse-power each.

The first drives two batteries, each of five heads of stamps; they are self-feeding, and each stamp weighs 6 cwt. The tramway from No. 2 shaft is 1,100 feet in length; and two trucks are used, each capable of carrying three tons.

The second engine—used for crushing and pumping—drives eighteen heads of stamps in three batteries. The weight of each stamp is 700 lbs.

This engine drains the whole line of reef, pumping about 1,000 gallons per hour.

About eighty feet east of the bottom of the main shaft (200 feet, in Wyndham claim) there is a small leader, about one inch in thickness, containing large quantities of iron pyrites; the only instance, the agent says, he knows of on this line of reef.

He states, that the wide body or mass of parallel veins, described above as occurring in the Wyndham Claim, makes its appearance at the sixty feet level, and continues down to a depth of 120 feet, where it develops into a number of leaders, not for the most part payable.

The four claims extend over a length of reef exceeding half a mile.

At Anderson's Creek, about fifteen miles from Melbourne, Allen's Reef, the Swedish, Victoria, and many others have been wrought with profit. They are generally very thin, and ramify in such a way as to make it difficult to trace them. Where they are for any considerable distance persistent, they yield a great deal of gold.

In the Swedish Reef 90 lbs. weight of quartz gave 144 ozs. of gold, or at the rate of 3,584 ozs. per ton. The depth at which the quartz was taken out was twenty-one feet.

Near the Koonung-Koonung Creek, six miles from Melbourne, there is a reef two feet in thickness, dipping east 35° to 40° , which has yielded 1 oz. per ton.

South-east of Mount Martha, and in other parts of the county of Mornington, as well as in the counties of Bourke and Evelyn, there are quartz veins sufficiently rich to enable the miner to make fair profits, where he has the means of crushing the stone at a moderate cost.

At Sunbury a vein of quartz, antimony, and gold—described in another place—has been worked for some time, and there is reason to believe that prospecting operations will shortly lead to the discovery of other veins in the same locality.

The most valuable reefs in the colony are found in the basin of the Bendigo Creek, at Sandhurst.

Among the most important on the west side of the stream are the Star Reef, Catherine Reef, St. Mungo Reef, Devonshire Reef, Bignell's Reef; a closely associated group of parallel reefs near Long Gully, consisting of Western and Eastern Victoria, Prince Alfred Reef, and others; and still proceeding south-easterly and crossing the creek—Sheep's-head Reef, Iron Reef, and Bird's Somerset Reef.

Westward of this main line are innumerable veins of considerable thickness and value; prominent amongst them being Phillip's Reef, Caledonia Reef, Metropolitan Reef, Glasgow Reef, Whip Reef, Brilliant Reef, Frenchman's Reef, Hibernia Reef, and others.

From the northernmost point of the Star Reef to the most southern point of the Glasgow Reef—a straight line with scarcely any break—we find an almost continuous lode, having a length of seven miles. On each side of this, and running nearly parallel with it, are numerous reefs of more or less value.

Six parallel reefs have been found crossing Long Gully, and to the south of these lies the well-known Hustler's Reef; and further to the west is Paddy's Gully Reef.

It is somewhat remarkable that throughout the large area lying to the south-east of the Bendigo Creek very few reefs have been opened.

Johnson's Reef, which lies to the north of Windmill Hill, has been well explored.

Some information respecting the workings of the Emu Company on this reef has been obtained by Mr. William Nicholas, one of the officers of the Mining Department.

FIG. 61.

a a a Quartz reef.
b b b Lava streak or slide.
c c c Rich dislocated spur.
d d d Western slide.
e e e Hard sandstone bar
with quartz casing.
f f f Sandstone bars.

This geological cross-section illustrates the Tiber valley and its surrounding geological features. The diagram shows a vertical profile with various layers and structures labeled with letters. At the top, a factory with a tall chimney is visible on the left. The Tiber river flows from the top right towards the bottom left. The geological layers are labeled as follows: 'a' for the uppermost layer, 'b' for a layer below 'a', 'c' for a layer below 'b', 'd' for a layer below 'c', and 'e' for a layer below 'd'. A vertical line labeled 'f' represents a fault or a boundary. The bottom of the diagram shows a horizontal line labeled 'g'.

SECTION OF EMU COMPANY'S CLAIM, JOHNSON'S REEF, SANDHURST.

The "lava streaks," or slides as they are sometimes called, do not terminate where they intersect and apparently alter the course of the reef, but continue a regular course through the strata to the east.

Between the bottom of the No. 1 Reef and the 240 feet level is a dislocated spur, in the vicinity of which the strata are found to be much disturbed. This spur yielded some of the richest quartz ever found in the Sandhurst District. The upper portion or first limb gave 6 dwts. per ton, and the second portion 20 ozs. per ton; and half a ton yielded 300 ozs. The upper third of this broken spur yielded $1\frac{1}{2}$ oz. to the ton, and the lower part 9 ozs. Throughout the spur iron pyrites and galena were found with the quartz.

In sinking the shaft a hard bar of close granular sandstone was passed through, which came in from the west at a depth of 220 feet. It was eight feet in width, and had on each side a very irregular casing of quartz.

The hard bar and spurs ran down on the east side of the shaft to a point where the western slide or fault set in.

A second hard bar of sandstone was intersected at a depth of 260 feet, and between this bar and the first there was found a soft dark slate, varying in thickness and filling the spaces formed by the neighboring harder bars.

Below the western slide the hard bars were represented by very poor white irregular bodies of quartz, divided by thin faces of slate, which were bounded on the west by another hard bar having an easterly underlie, and on the east by the No. 3 Reef. The western bar and the No. 3 Reef underlying in opposite directions, wedged out this mass of irregular quartz above the point of intersection at a depth of 400 feet.

Fig. 62 shows a longitudinal section of the Eagle Mining Company's works, at Specimen Hill Reef. The reef was first opened in September, 1853, and was worked by parties of miners holding small claims, varying from twelve feet to forty feet in length along the line of the reef. Subsequently—some time in August, 1859—McNair and Company, who held two of the original claims on the crown of the hill, purchased all the adjoining claims. Before McNair and Company had purchased the claims the reef had yielded 12,500 ozs. of gold; and, during the period they held it, it gave about 2,000 ozs. The main shaft is sunk on the underlie of the reef.

Public companies afterwards worked the ground held by McNair and Company—some 200 feet along the course of the lode—and they got over 10,000 ozs., making a total of 24,500 ozs.



FIG. 62.

Many of the original claimholders' shafts are shown in the section, but few of them were sunk to any depth below the water-level. As soon as the water was reached they were compelled to relinquish their claims. Baling with windlass buckets was useless, and the horse whim of McNair and Company was scarcely sufficient to enable them to reach a depth of 280 feet.

The public company, subsequently formed, sank an engine shaft on the dip of the reef. The shaft is divided into three compartments; two for winding, and one for pumping and a ladder-way.

They afterwards erected a pumping and winding engine, and a crushing engine and plant working twenty-four heads of stamps of 8 cwt. each.

The average thickness of the reef throughout the mine is about thirty inches; and the average yield, from the surface to a depth of 200 feet, $3\frac{1}{2}$ ozs. per ton.

The richest parts occur in patches.

At the 430 feet level the reef, where cut by the shaft, is about twelve feet in thickness; but about sixty feet from the shaft the reef was cut off by a lava streak, which took its place and followed its course. This was followed for a distance of 200 feet without any change.

At 516 feet, the bottom of the shaft, the reef is only from four to six inches in thickness.

The Catherine Reef exhibits some peculiarities which should engage the attention of geologists.

The following information, relative to the mine of the Catherine Reef United Claimholders Gold Mining Company—which is believed to be second in importance only to the Port Phillip Company's mine, at Clunes—has also been obtained by Mr. William Nicholas:—

The hill on which the operations are carried on consists of a vast network of quartz spurs, traversing the slates and sandstones near the surface in all directions, but with some appearance of general uniformity. The greater number of them may be called "flat spurs," and these, as a rule, have been the richest.

A section across the hill, at the No. 3 shaft, would show several spurs, cropping out on the eastern side of the crown of the hill, which underlie to the west up to a point where they are met by a course of sandstone thirty feet in thickness, which runs nearly parallel with the main lode, but at some distance to the east of it. Through this sandstone they run horizontally, as "flat spurs," to the point where the slate sets in, where they again assume their former dip, and either form a junction with the main lode or run out before reaching it.

Just below the upper system of spurs a well-defined wall makes off to the east, with the same underlie as that of the main lode, which dips to the west. This wall carries with it a well-defined spur or leader, locally called the "Crisp Spur," from its brittleness. It is composed of thinly laminated quartz, between the faces of which black slate and iron pyrites are found.

This wall and the accompanying spur have been traced throughout the whole length of the company's ground, to a depth of 150 feet on the course of the wall, or to a depth of 300 feet in the mine. From this eastern wall offshoots or spurs make off, one under the other, which run nearly parallel with the main lode.

The upper spurs, after leaving the eastern wall, have a regular underlie as far as the sandstone bar, through which they run in quite flat bands; and here, as with the other spurs above the eastern wall, they either join the main lode, or run out altogether.

The strata between the main lode and the eastern wall are composed of slate and sandstone, for the most part underlying east in about two feet in six feet, the spurs crossing the laminations nearly at right angles.

Fig. 63 shows a section of the spurs where the sandstone is crossed, and where they are cut off by bars or heads of slate. They are situated just above the No. 1 or ninety-one feet level.

In this mine, the spurs which occur in sandstone are richer than those found in the slate.

Two extensive surface cuttings have been opened for the better working of these spurs, that on the north side of the hill running south, and that on the south side working towards the north. Together they have been wrought for a length of 400 feet, by an average width of fifty feet. The depth is about 60 feet.

Four levels have been driven from the main shaft on the main lode (the western limb of the Catherine Reef), as follows, viz.:—The No. 1, or ninety-one feet; the No. 2, or 156 feet; the No. 3, or 226 feet; and the No. 4, or 292 feet level. The total length of the levels is 4,350 feet; and throughout the whole of them the lode has been found to be uniform in its character. The average width is about five feet, and its underlie three feet six inches in six feet (western). But though a finely-formed reef, it has not everywhere been rich.

The lode itself, comparatively poor, is remarkable because of the rich leaders, flat spurs, and offshoots, which are found everywhere near it.

A cross-cut is now being driven at a depth of 416 feet in the main shaft, which will intersect the main lode, where rich stone, it is expected, will be found.

Figs. 64, 65, and 66 are taken at the end of a winze sunk on the underlie of the lode, between the No. 2 and No. 3 levels. They show the character of the lode at several depths twenty-five feet from each other.

Fig. 64 shows the reef immediately below the floor of the No. 2 level. In the upper portion it is narrow—about twelve inches

FIG. 63.

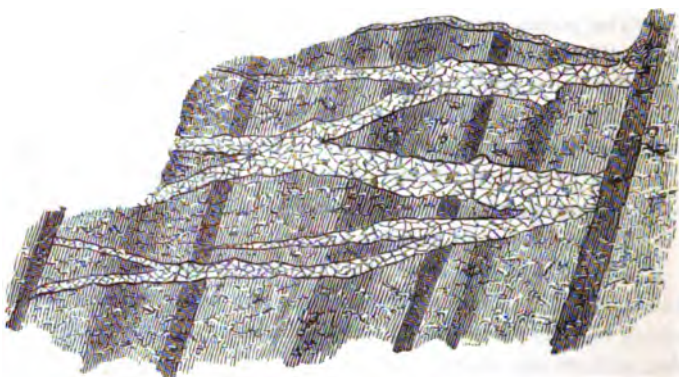


FIG. 64.



SECTION ACROSS MAIN LODGE.

in thickness—but at the foot it increases to four feet. Many spurs branch off into the foot wall, which is composed of black, blue, and white slates. The colors show distinctly the laminations of the slates, which run parallel with the varying line of the foot wall.

The cause of the thinness of the lode in the upper part is due to what is called locally a "horse of slate," which has split up the reef in the No. 2 level. Lying on the back of the lode is a vein composed of thinly laminated quartz, and between the laminations is found a black, highly-polished slate. This vein constantly accompanies the lode in such places. It varies in width from one to six inches. On this vein is a layer of sandstone two feet in thickness, which is overlaid in turn by a "lava streak," or "flookan," or dyke, about fifteen inches in thickness, and again by sandstone, which is supposed to form the real or standing back of the lode.

Fig. 65 shows a section of the reef at a point where it is of the usual thickness, and where it encloses what is called "floating schist."

Fig. 66 shows the formation of the reef at a point over the 226 feet or No. 3 level. The floating schist is found here in larger quantities, and nearer the hanging-wall side of the lode.

FIG. 65.

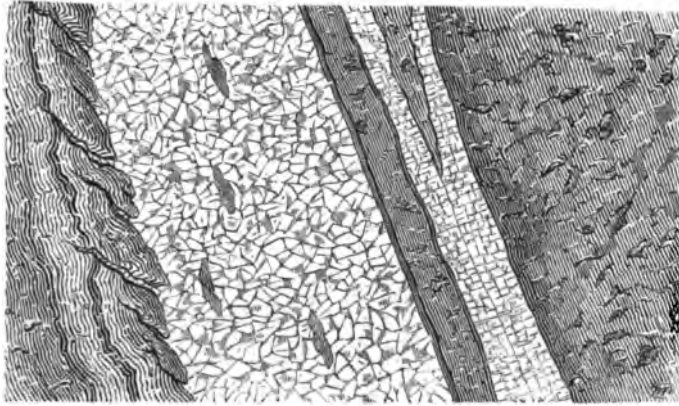


FIG. 66.

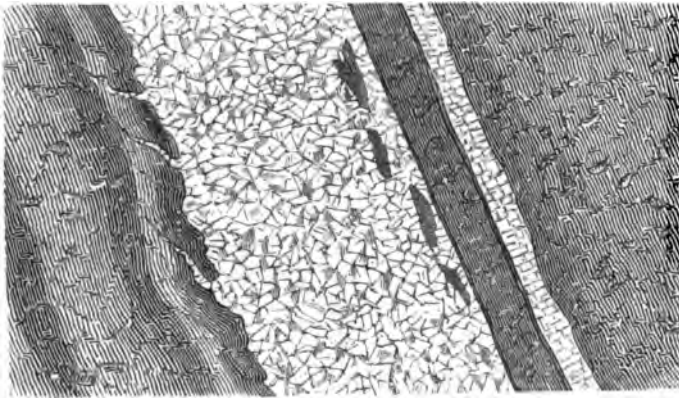
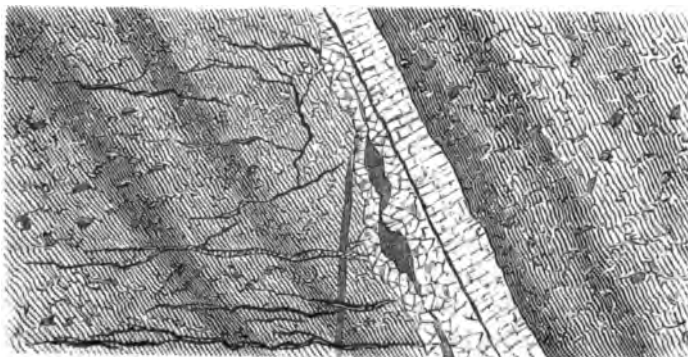


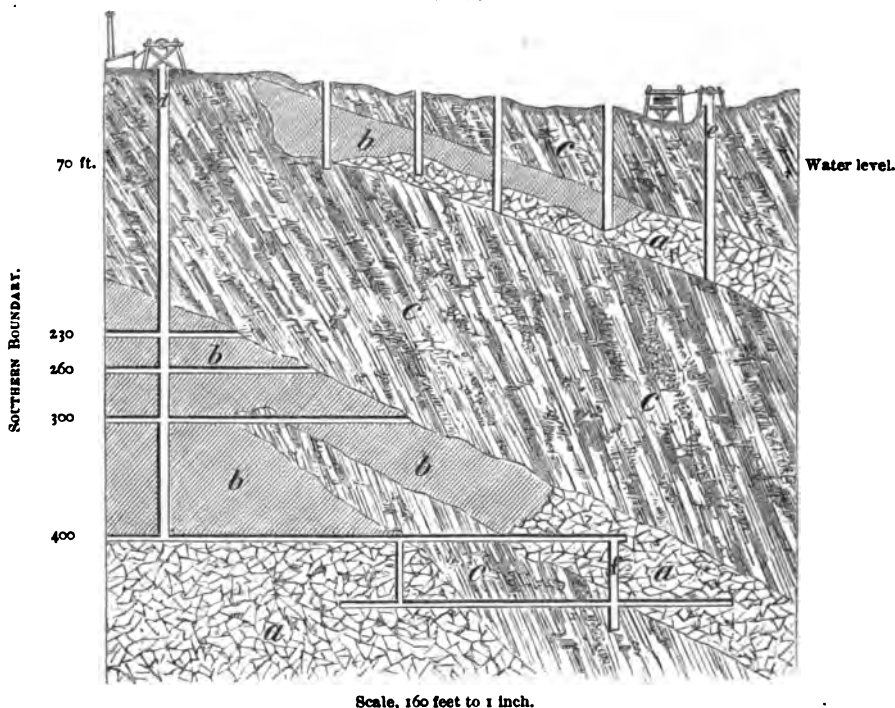
FIG. 67.



About 200 feet south of the bottom of the winze is the end of the No. 3 level (see Fig. 67), where the lode is irregular. The laminated quartz spur separates the lava streak from the reef, and overlying the streak is a tight close-grained sandstone. The floating schist again occurs, and the foot wall is composed of sandstone, traversed by thin bands of perpendicular slate, precisely of the same character as that enclosed in the lode.

Messrs. Latham and Watson's claim on Hustler's Reef has been wrought, for some years, with profit, and it is to be regretted that precise, accurate information

FIG. 68.



Scale, 160 feet to 1 inch.

LONGITUDINAL SECTION FROM N. TO S. OF LATHAM AND WATSON'S QUARTZ MINE, ON HUSTLER'S REEF, SANDHURST.

a a a Solid quartz. b b b b Worked portions. c c c c Slate and sandstone. d Engine shaft.
e Whim shaft. f Hydraulic shaft.

respecting it is not to be obtained. Messrs. Latham and Watson have, however, furnished some facts which are interesting; and the section of the mine, Fig. 68, has been prepared by them.

According to their statement the reef was first opened by Jonathan Harris, in 1853; and, in conjunction with the late Thos. Hustler—whose name the reef bears—they purchased a small claim on it, about twelve feet by twelve feet.

The reef in the claim was remunerative from the surface downwards; and the first crushing yielded 26 ozs. per ton. Some parts yielded as high as 100 ozs. per ton; and the rich specimens exhibited in the Melbourne Exhibition, in 1854, obtained for the proprietors a medal.

Subsequently, the spirited holders of the small claim purchased several of the adjacent properties, and they finally obtained a lease of a considerable area.

Some three weeks' crushing gave them 1,270 ozs. of gold, and, as all this was retorted at one time, the cake created quite a sensation in Sandhurst.

In 1860 they purchased another claim, and now hold, altogether, about 200 yards along the course of the reef.

The explorations in the mine have led to the discovery of a second reef. There are two saddle reefs one over the other, having 200 feet of slate country between them. Both reefs contain gold in considerable quantities. The upper reef was worked first. It out-cropped in the claim first purchased by Messrs. Latham and Watson, and was wrought for a width of eighteen feet, and to a depth of twelve feet. This was the cap of the reef. Below, the reef split into two legs or reefs—one having an underlie to the east and the other to the west. Both these legs were worked to a depth of fifty feet from the cap.

The cap of the reef dips to the north at an angle of one in three. This angle soon brought the reef under the water-line, which, before drainage was attempted, was fifty-four feet from the surface.

They had to contend with a heavy flow of water for some time, and for drainage purposes horse-whims were of little use and expensive. Though the quartz gave much gold it soon became evident that some better appliances were required for the proper drainage of the mine, if it were to be wrought economically; and accordingly, when Messrs. Latham and Watson became the sole proprietors, they sank a shaft near the northern boundary of their land, and erected a machine for baling and hauling quartz.

This was effective for some time, but at last proved insufficient, and the quartz was unremunerative.

Believing that a reef would be found within their ground at a greater depth, they put down a shaft near the southern boundary to the depth of 200 feet, where the cap of the reef now being worked was broken into, and the water came in in great quantities. The baling engine was removed from the northern to the southern shaft, in order to test the discovery. The cap was sunk through, gold was seen in the quartz, and a level was opened out at 230 feet from the surface. These explorations showed that there was a true lode of the "saddle formation," having a cap and two legs similar in many respects to the upper reef.

The shaft was afterwards sunk to a depth of 400 feet, and levels opened out at 260, 300, and 400 feet. The reef has yielded well. From the 400 feet a blind shaft was sunk to a further depth of fifty feet, and levels opened out therefrom. The hauling in this shaft is effected by hydraulic power. The water brought from the surface has a pressure of 160 lbs. to the inch, and the arrangement has proved to be an economical one. The cap of the reef varies from sixteen feet to thirty feet in height, and the average width is twenty feet. The eastern limb at its commencement is five feet in width, tapering in 200 feet from the cap to fifteen or eighteen inches. The western limb, commencing about five feet in width, tapers in seventy feet to one foot, and thence becomes too small to follow. It will be seen in the section, where the eastern leg only can be shown, that a fault or break occurs, which increases in size with the depth to which it has been followed.

Only fine gold is obtained from this mine. It occurs only in small particles; the greater part being too minute to be seen by the naked eye; and the quartz, especially in the lower portion of the eastern limb, is largely impregnated with sulphides. The gold is generally closely associated with those, rendering amalgamation difficult.

In addition to the reefs just described, there is another parallel reef in the ground having an easterly underlie. This reef lies on the eastern side of the reefs before-mentioned, and from the northern portion of the ground (from whence it has been worked to the north with great success by the Hustler's Reef Company) Messrs. Latham and Watson obtained some splendid yields, but towards the south it is broken up and contains but little gold.

The baling engine before spoken of was soon found to be inadequate to the work, and a more powerful engine with complete winding machinery, capable of raising 3,000 gallons of water and twenty trucks (equal to four tons) per hour, was at last erected.

This mine has been constantly and energetically worked by Messrs Latham and Watson, from the earliest days of quartz mining in the colony up to the present time; and they gladly record the fact, that their works have been conducted in such a manner as to preserve from injury the workmen employed by them. Up to a recent period no serious accident had occurred.

The gradual improvement of appliances for the reduction of quartz, as shown in the history of this claim, is interesting. In 1853, the quartz was crushed by a dolly (see Fig. 69), but immediately after their first purchase, Messrs. Latham and Watson constructed a stamping-machine with a grating, the gold being obtained by cradling. This was the first stamping machine constructed in the colony, and a model of it, which is now in the National Museum at Melbourne, was shown in the Bendigo Exhibition, 1854. To this machine horse-power was soon added, and subsequently a steam engine was made to do the work of horses. The wooden stampers were shod with iron, and were made to fall on a solid iron bed. A stream of water carried the crushed quartz through wire gauze and over quicksilver wells, in the formation and distribution of which the owners, guided by their experience, effected many improvements.

FIG. 69.



The wooden stamps were replaced by wrought-iron shanks, with square cast-iron heads cast on; and these again have been replaced by revolving stamps with turned shanks, loose heads and shoes, each falling on a false or loose bottom in the cast-iron stamper-bed, and having perforated iron grating for the pulverized quartz to pass through. Copper plates, blankets, and barrels have been added, and numerous contrivances for saving gold have been from time to time tried and cast aside.

The engine first erected was discarded some years back, and the second engine is about to be replaced by a more powerful one, which is now on the ground. It will drive the plant of twenty heads of stamps, and, in addition to pumping, will crush 250 tons of quartz per week. The proprietors propose to add machinery for extracting gold from the tailings, in which pyrites abounds.

The amalgamation is effected at present by fifteen quicksilver ripples on each table, the intervening spaces being covered with copper-plates, and there are eight feet of copper plates at the end. On leaving these tables the tailings pass over nine feet of blanketing, washed at intervals of two hours, for the purpose of obtaining the pyrites adhering thereto. Before reaching the tailing-heap a further saving of fine gold is effected by Lewis's process, and it is believed that the quantity of free gold which escapes is small.

It is not possible to give an estimate of the total amount of gold got from this claim. Information on this point would be of the highest interest, because it is believed by many that it is the most valuable claim, having regard to its extent, that has yet been wrought in Victoria.

The annual profits are supposed to be very large.

Messrs. Latham and Watson have given the expenditure, approximately, since they became possessed of the claim. The figures are as follows:—

	£
Wages - - - - -	70,000
Engines and machinery - - - - -	20,000
Expenses of machines - - - - -	10,000
Mining - - - - -	15,000
Purchase of claims - - - - -	7,000
	£122,000

A drawing of a piece of quartz taken out of the lode at a depth of 450 feet is shown in Fig. 70. The block is regularly laminated, and both sides are covered with dark-blue slate. It is a piece of the reef, in fact, of the full width at this depth. The sulphides of iron and lead occur in the laminations, and the gold, of which a good deal is visible to the naked eye, is mixed with the sulphides. The quartz is white, dense, and hard.

It is worthy of note that in this mine the gold is aggregated in cavities with the softer sulphides, such as galena, and is rather sparingly diffused in the laminæ which enclose iron pyrites.*



QUARTZ FROM MESSRS. LATHAM AND WATSON'S CLAIM.

* Up to the present time, it is believed, attention has not been directed to the fact that where various sulphides occur in a vein the gold is nearly always associated with the softer sulphides. It is of peculiar significance and importance, and deserves the consideration of engineers and others who have attempted to produce efficient machinery for collecting the auriferous sulphides.

In Messrs. Latham and Watson's mine the work is easy, because the galena has a specific gravity of 7.4 to 7.6, and is only 2.5 in the scale of hardness.

It would be possible to write a volume illustrative of the reefs at Bendigo, and every page would be full of facts valuable both to the practical miner and to the man of science. Enough has been given to show that here, as elsewhere in the colony, men possessed of the requisite experience and ability are grappling with the difficulties involved in the working of the mines, and the separation of the gold from the sulphides and quartz.

Some of the reefs, as the Whip Reef,* are composed almost wholly of pyrites, and contain both gold and silver; and, it is to be hoped, they will at no very distant period be properly explored, and the minerals which they yield so abundantly be treated by those methods which practical chemists would adopt. Energy and perseverance, and the expenditure of capital, are all useless unless practical science be the guide, and enlightened experience the instructor.

At present there are 3,000 quartz miners in the Sandhurst Division, and steam engines of the aggregate of 2,034 horse-power, giving motion to 1,012 stamps.

The quartz reefs of this division are well formed, generally continuous for considerable distances, reasonably thick, and very rich, and yet they have not been wrought as they ought to have been.

In the Nuggety Reef, at Maldon, the löllingite, with which the gold is associated, has a hardness of 5.5, and a high specific gravity—7.0 to 7.3.

Pyrrhotine, which occurs in the same mine with the gold, has a hardness of 3.5 to 4.5, but its specific gravity is only 4.6.

The common iron pyrites varies in hardness from 6.0 to 6.5, and its specific gravity is 4.9 to 5.1. Gray antimony has the specific gravity of 4.6, and its hardness is 2.0. The oxyd, in the form of valentinite, varies in hardness from 2.5 to 3.0, and its specific gravity is 5.5.

The diverse character of the minerals with which gold is associated makes it difficult to devise machinery which will save all the auriferous vein-stuff.

The machinery which is effective in one mine fails in another; and never, as far as is known, has this been attributed to the right cause—the differences in the hardness and the specific gravity of the auriferous sulphides.

* The letters of the special reporter of the *Argus*, who made an examination of the goldfields of Victoria in 1862, are full of valuable information, and contain some facts connected with the mining operations on the Whip Reef which are of high interest. He says:—"The top stone from the surface gave from 5 ozs. to 9 ozs. of gold to the ton. The quartz was whitish in color, largely abounding in pyrites. The reef got thin as it was followed down, with an underlie to the east, and a shaft was sunk to catch it at some distance from the original workings. Here, at a depth of 170 feet, an enormous mass of metal, or conglomerate of metals [pyrites], was cut into. It has been ascertained to be twenty-five feet thick, and it has been opened up to a depth of sixteen feet without the lode being passed through. The gold in this mass was unequally distributed. When treated in the ordinary way it gave an average of 1 oz., but it was so rich in patches that an assay showed that it contained from 90 to 100 ozs. of gold to the ton. The first assay indeed gave the extraordinary result of 500 ozs. of gold to the ton, and other samples, subsequently analysed, were still richer. * * * * *

"Samples of the ore were sent home by the Messrs. Bannerman, who are interested in the reef, and the report of the chemical analysts who made the assay shows that it contains silver at the rate of 4½ ozs. to the ton, as well as arsenical pyrites and gold."—*The Goldfields of Victoria in 1862*, p. 72 and 73.

It is probable that, if no better method be discovered, this pyritous reef will be treated after the well-known American method. Stacked in layers with some combustible material between each layer, small coals, gum leaves and the like, it would slowly decompose, yielding many valuable products and setting free the gold, which would be easily collected by the ordinary method. Such a reef as this in any part of Europe would be considered of enormous value, and at once energetically worked.

But for the difficulties which have been it might almost be said placed in the way of the quartz miner, Sandhurst might at the present time be producing annually, from its quartz reefs alone, as much gold as has been got from all the goldfields of the colony during the year 1867.

These difficulties are not of such a kind as any mine owner or any company can surmount. Whole lines of reefs are now idle because there is no bye-law which sufficiently provides for the drainage of claims. On the one side we have the machine-owner, who says he is draining the line of reef, and on the other a number of claimholders, who say they derive no benefit from the pumping apparatus. With a water-line standing naturally at say ninety feet, with a number of claims having shafts from 20 feet to 400 feet in depth, it is obviously not easy, yet not impracticable, to say what each claimholder should pay towards the maintenance and working of an engine which night and day is drawing from a deep shaft a certain quantity of water to the surface.

This difficulty has, unfortunately, not yet been met. Until there is co-operation, until large areas are taken up by large companies, until the interests of the miner who is getting out quartz are identical with the machine-owner who is pumping, the question will not be solved. In the meantime the district is suffering, and a locality which might rival in importance and wealth the largest goldfield in the colony is, if not languishing, at least far from so prosperous as its natural advantages, if properly developed, should make it.

Mr. Crawford Mollison, the Police Magistrate and Warden, who has devoted much time and thought to this subject, and has again and again made useful suggestions as to the mode in which the difficulties might be overcome, has, at the request of the writer, prepared the following statement relative to the water-levels in the lodes on this goldfield :—

“From the information I have been able to obtain from the managers of some of the oldest and most important mines in this division, it appears that the average depth of the original water-level in thirteen mines was slightly over ninety-one feet; and it also appears that, when the mines are situated in valleys, the depth of the former water-level ranges from twenty feet (Hibernia Reef) up to about ninety-six feet, and when the mines are upon the hills, the depth of the former level ranges from about 110 feet up to 170 feet. The water-levels are, therefore, in all probability, pretty uniform in height over the whole of the lodes in which the mines spoken of are situate. The present depths arrived at in the mines in question range from 186 up to 450 feet, and the water is only kept from rising to its former level by an almost continuous pumping. Mr. Eyre, the manager of the Catherine Reef United Claimholders' Company, is of the opinion that there is less water in the rock abutting upon the lodes than in the lodes themselves; but although that gentleman's ability and experience make his opinions weighty, it may not be safe to found a conclusion upon one example only.

“The water does not appear to be less brackish than formerly (although pumping has been going on in some of the mines for many years), and the manager of the Hustler's Reef Quartz Mining Company thinks that it becomes more charged with salts as their mine deepens. In no case, that I ever heard of, is the water from a quartz lode in this division so free from mineral matter that it can, without injury to the boiler, be used for raising steam from, although sometimes necessity compels its use for that purpose. The reef water, in common with other brackish water on this goldfield, has the peculiar property of separating from any aluminous earth that it may

be mixed with, when allowed to be at rest; so that the puddler, when he uses brackish water, can get it back when the earthy matter is precipitated, and use it over again; but pure rain-water, when mixed with the red clay, found in all the gullies in this division, never separates from it, except by evaporation; so great, apparently, is the affinity of one for the other, when it is not neutralized by the presence of mineral salts.

"Independently of the difficulty met with in attempting the drainage of the lodes in consequence of the impossibility of inducing the claimowners to co-operate for drainage purposes, the mechanical difficulty is very considerable, as oftentimes the lodes upon the same line of strike appear to have no channel of communication from one to the other by which water could pass to the draining well. It was once proved in evidence that the water in a claim on Paddy's Gully Reef stood about 100 feet higher than it did in the pumping shaft of another claim in the same general line of reef, although there was only a distance of about 150 yards between the claims. On the other hand, it has been ascertained that, on the Star Reef, claims have been benefited by drainage, although situated two-thirds of a mile from the pumping-engine. These facts, although isolated, seem to show that, sometimes, the lodes, being separated and not meeting in consequence of having a similar amount of dip, do not readily drain water from one into another; and at other times the lodes appear to run without a break and nearly parallel to the surface for considerable distances, and with a free drainage throughout.

"As what may be termed the mother lodes of this goldfield are now occupied by miners for a continuous extent of about eight miles, it appears to be a fair subject for enquiry whether the whole of the mines upon the lodes in question might not be consolidated for drainage purposes, and the steam-power be assisted by two principal adits, grading towards and joining at Bendigo Flat, at which point the water must, no doubt, be raised to the surface by steam or Coliban water-power, but much of the expense of raising the water to high ground before it can be discharged, would be saved."

Mr. Hart, the mining surveyor, having kept a record of the original water-levels on some of the Sandhurst reefs, has furnished expressly for this paper the following figures:—

**"REDUCED LEVELS OF ORIGINAL HEIGHT OF WATER IN SOME OF THE PRINCIPAL REEFS
IN THE SANDHURST DISTRICT.**

(Datum level, Hobson's Bay low-water mark.)

	Feet.
Devonshire and St. Mungo Reefs - - - - -	704.00
Hustler's Reef - - - - -	681.13
Johnson's Reef - - - - -	642.96
Perseverance Reef - - - - -	694.54
Redan Reef - - - - -	688.85
Star Reef - - - - -	630.66
Victoria Reef - - - - -	702.83
Wetherall Reef - - - - -	675.96."

In the Heathcote and Waranga divisions of the Sandhurst Mining District there are auriferous reefs east of the town of Heathcote, intersecting the ranges forming the basin of the Deegay Ponds; on the Cornella Creek, near Mount Pleasant; east of Sandy Creek, close to the River Goulburn; and at Rushworth, Whroo, Waranga, and other places; and large areas are yet unexplored.

Some of the reefs are of great interest, but there is not much information to be obtained in regard to their modes of occurrence.

At Waranga many of the reefs, it is said, run at right angles to the strike of the rocks, rendering the exploration of them both difficult and expensive.

For a long time the miners in this division were content to use the old wooden windlass. The shafts were about thirty feet apart, and each shaft, if shaft it might be called, followed the underlie of the reef. The quartz was removed altogether, and the walls were supported by timbers rudely placed across from the hanging to the foot wall.

The rock was drawn from the mines in oil drums, sliding on skids formed of saplings barked and trimmed.

Reefs giving less than 1 oz. of gold per ton were not considered worthy of attention in former years; * and even now the appliances are not equal to the work of extracting gold from what might be called in such a district poor reefs.

At Heathcote quartz yielding 3 ozs. and more per ton has frequently been raised; at Costerfield, some samples have given 9 ozs. 16 dwts.; at Redcastle, 10 dwts. to 3 ozs. are not uncommon; and at Rushworth the average has varied from a few pennyweights to nearly 4 ozs.

Some small veins in various parts of this district have yielded very largely; and it is to be regretted that capitalists have not given their attention to the quartz mines of this part of the colony.

Some of the claims—as for instance those held by Messrs. Lewis and Company—have been wrought for many years, and have produced enormous quantities of gold; but there are no facts connected with the management or working of them which would be of more than passing interest. Drawings and sections illustrative of the reefs and workings would be useful, but these have not been supplied by the mine owners.

At Lockwood, Marong, Sebastian, Raywood, and Kamarooka, very rich reefs have been opened up; and all the country lying to the west and north of Sandhurst, as well as that to the east, beyond the Campaspe, is deserving of the attention of the quartz miner.

Mr. Hugh Glass, who is the proprietor of the land on which the Sebastian gold-field is situate, has been good enough to cause his agents to furnish information respecting the principal reef.

The reef is worked by the Frederick-the-Great Company. The depth of the main shaft is 150 feet, and the length of the main drive 350 feet. The water-line was found at a depth of 150 feet. The vein is described as a mass of leaders, varying in width from six inches to six feet, and occupying a space about forty feet in width. It underlies very slightly to the east, and the whole mass dips towards the south. The quartz is rubbly, and contains but little pyrites. The gold is pure, not associated with sulphides, and generally fine. Where rich patches occur, coarse pieces are found, but they are not numerous.

The average yield per ton up to the present time is $5\frac{1}{2}$ dwts.

There are two engines; one of sixteen horse-power, which drives three batteries of six stamps each. The weight of each stamp is 6 cwt. The same engine moves also the tailings-pump and the pump for bringing water through three-inch pipes from

* *Mining Surveyors' Reports*, p. 273, vol. III.

the creek, which is distant 740 yards. The length of boiler is seventeen feet; the diameter, five feet six inches; and the length of stroke two feet six inches. The other, a twelve horse-power portable engine, is used for raising stuff.

The company is composed of eight working shareholders, who employ from thirty to forty men; and Mr. Glass's agent points to it as an illustration of the benefits arising from this system of co-operation, whereby the expenses of management, which in so many cases absorb the greater proportion of the profits of other mines, are avoided. The company commenced operations in November, 1864, and they have been working ground more or less payable ever since. They are now working at a depth from the surface of eighty feet only, although they have a prospect drive of 250 feet at the water-level. At this depth, 250 feet, they have not succeeded in obtaining payable stone. The run of gold is supposed to be south of the further extent of their drive.

The claim is one of the most advantageously worked, and the mine the best timbered, perhaps, in the district. Such is the quantity of timber used, that were it not plentiful in the immediate neighborhood, the mine would have failed to pay expenses in some parts of the reef, instead of yielding, as it has done, a handsome profit.

There is also an alluvial lead running through the leasehold, which once yielded well, and which contains cement that, from trials made, is believed to be worth working.

Throughout the Kilmore Division we find innumerable reefs of quartz. On the Reedy Creek, Strath Creek, King Parrot Creek, Tea-tree Creek, and Muddy Creek, the miner can everywhere find good stone. If the veins are not thick, they yet yield well. On the Carrier's Reef, at Yea, one parcel of forty-nine tons gave 500 ozs. of gold; and ten tons from the same reef an average of $17\frac{1}{2}$ ozs. per ton. The Providence Reef, two feet in thickness, has averaged $2\frac{1}{2}$ ozs. per ton; and Thrupp's Reef, on the same hill, has given 3 ozs. per ton—the reef being ten inches in thickness.*

There is work in this large area for thousands of miners; and ultimately—when suitable machinery is introduced—the annual yield of gold will be largely augmented by operations on the ranges adjacent to the numerous creeks falling northwards to the Goulburn.

Auriferous reefs are found in nearly every range in the eastern and southern portions of the Mining District of Maryborough.

At Talbot, Amherst, Maryborough, Avoca, Homebush, Redbank, St. Arnaud, Dunolly, Jericho, Kingower, Inglewood, and northwards for a distance of more than sixty miles from the Dividing Range, they are everywhere outcropping; but, except in a few places, they have not been wrought with that energy which the rich yields might have called forth.

There is one thick reef at Avoca which has been traced for a distance of seven miles.

When we look at the great horizontal extension of these reefs, the value of the stone found in every part of them—even to such depths as 600 feet—and the modes in which they occur; it seems indisputable that, as soon as the miners are able to form themselves into companies and to merge their small claims in large areas, this district will become rich, and afford abundant opportunities for the safe investment of capital.

* *Mining Surveyors' Reports*, p. 149, vol. II.

From the Mariner's Reef, at Maryborough, stone has been got at a depth of 600 feet from a vein two feet in thickness, which has yielded well. Thirty tons gave 251 ozs. 15 dwts., or an average of 8 ozs. 7 dwts. 20 grs. per ton.* The lode can be traced on the surface for about 1,200 feet, and the average thickness is about twelve inches. The water-level is found at a depth of 200 feet. Above this line the quartz is clean, but below the water-level it is largely mixed with pyrites; so that the amount of gold *extracted* by the ordinary processes is no fair criterion of the quantity contained in the lode.

The total quantity of quartz raised is stated by the mining surveyor to be 3,340 tons, and the total quantity of gold obtained therefrom, 33,400 ozs.

There are forty-four head of stamps worked by an engine of fifty horse-power.

The vein at the greatest depth—650 feet—is from four to fourteen feet in thickness, and the yield, at the place intersected by the drive, varies from 2 to 15 dwts. per ton.

The District of St. Arnaud is perhaps the most interesting to the geologist and mineralogist which is to be found in the colony. Here, as at Pleasant Creek and Waranga, we find numerous cross lodes; and these, running nearly in the direction of the strike of the rocks, occur so close together as to render any attempt to trace them with a view to connection perplexing and difficult.

Dykes and bars, composed of brown iron ore, are numerous; and in the veins are found auriferous quartz, arsenical and common iron pyrites, the ores of copper and native copper, the ores of silver and native silver, galena, &c.

Mr. Ulrich has made a careful examination of the reefs at St. Arnaud, and the following facts are taken from his report.

The Trinidad Reef is about three feet in thickness on the surface; its strike is N. 40° W., and its dip is easterly from 80° to 85°. The quartz is hard and compact, and full of thin veins of brown iron ore; and small patches of iron and arsenical pyrites are found here and there, mostly half decomposed. The yields have been 2 ozs. per ton from near the surface. In depth the proportion of gold was less—about 15 dwts. per ton—and silver, it was said, was mixed with the gold.

The Argentine Reef—about five chains from the Trinidad Reef—is probably a continuation of the latter. Its strike is the same, and it has a westerly dip of 86°. The quartz is not similar in character. It is highly charged with brown iron ore and psilomelane, and resembles what is called in the Sandhurst District *mice-eaten* quartz. From experiments which have been made it is believed that this vein is rich in the ores of silver; and it is beyond doubt that it contains gold. The chloro-bromide of silver is the form in which the ore occurs.

The Warwickshire Reef has the same strike as the others, and an easterly dip of 70°. It is from eighteen inches to two and a-half feet in thickness, and is dense and solid, and contains thin veins of brown iron ore. At the surface the yields were from 3 to 4 ozs. per ton; but in depth they fell off, iron and arsenical pyrites, it is said, being found in the lower parts of the workings. The gold in some cases contained a small admixture of silver.

The Rotten Reef lies about fifteen chains north-easterly from the Warwickshire Reef. It is well defined, and varies in width from two to four feet, and has a high westerly dip. Its strike is the same as the others. The quartz throughout is highly

* *Maryborough and Dunolly Advertiser*, 12th November, 1866.

ferruginous; and in some places there is a regular breccia, composed of pieces of quartz and slate cemented by brown iron ore. The trial crushing produced 15 dwts. per ton, and the gold was found to occur in patches in the brecciated parts of the reef.

The Queen Semiramis Reef lies a little to the west of the Rotten Reef. Its strike is N. 25° W., and its dip is 70° westerly. It may be called a cross reef, the strike of the rocks being N. 40° W. The quartz is hard and compact, showing impregnations of iron and arsenical pyrites in moderate quantity. The yields, it is said, have been, from near the surface about 1½ oz. per ton, decreasing in depth to ½ oz. per ton.

The Sebastopol Reef is situate about five chains east from the Rotten Reef. It appears to be the middle lode of three enormous outcrops of one large lode; the southward one being represented by the celebrated Wilson's Reef, and the northern one by the equally well known Silver Reef. In the spaces between these outcrops the lode probably either parts into strings or is less conspicuously developed, or is covered with *detritus* from the adjacent higher ground.

Terminating abruptly towards the north, the Sebastopol Reef is from 60 to 100 feet in thickness, and forms the crown of the spur; and part of its western face, about ten feet in thickness and half a chain in length, rises as a steep wall to a height of nearly twenty feet. The mean strike of the whole mass is N. 36° W., and it has a westerly dip of 70°. From the explorations made on the northern steep slope of the hill, it appears that there is not one solid mass of quartz, but a number of branches and leaders of variable thickness, with light-yellow rather friable sandstone in the interspaces.

Arsenical pyrites is found in considerable quantities in the lode, and according to an analysis made by Mr. George Foord, contains nearly 6 ozs. of gold per ton. The yields have hitherto been very low, but, different from the other reefs, there is a tendency to an increase in depth. At the top the yield was 1 dwt., and at fifty feet 4 dwts.

The Armenian Reef lies about five chains eastwards from the Sebastopol Reef. Its strike is N. 36° W., and its dip is 75° westerly. It varies in thickness from ten to fifteen feet. The quartz is pretty solid throughout, and contains an abundance of arsenical pyrites. The crushings from this reef gave, near the surface, an average of ½ oz. of gold per ton, but decreased in depth to 4 dwts.

Wilson's Reef is identical in strike with the Sebastopol Reef. It is one of the most interesting features of the district, both as regards its massive development and its mineral contents. It occupies for a width of nearly 100 feet the crown of a high hill; and has yielded from 10 to 12 ozs. of gold per ton. Its dip generally is westerly, varying in places from nearly vertical to 75°. As a solid reef it extends for a distance of 400 feet only: both towards the north and the south it splits into veins, terminating at the south point in a steep bluff, which has been extensively wrought, and given good returns of nuggety gold.

The quartz in some parts is of a yellowish or greenish color, and very much eaten out; and in others white and dense, with ferruginous veins and specks of arsenical pyrites throughout. Veins of a white soapy clay traverse the face of the reef in all directions, and rather large generally square pieces of bluish-black slate are abundantly enclosed in the quartz blocks.

This reef is the site of the works erected by the St. Arnaud United Quartz Mining Company.

Mr. Ulrich gives a clear account of their operations in his report, and adds the following interesting statement, derived from analyses made by Mr. Latta, the chemist of the Port Phillip Company, Clunes, relative to the proportions of gold and silver in the pyrites, galena, &c.:—

	GOLD.		SILVER.	
	dwt.	gr.	dwt.	gr.
“ 1. Slime from lower half of race below the settling boxes - - -	6	3.84	24	20.16
2. Slime from upper half of race below the settling boxes - - -	5	18.88	25	22.72
3. Sludge from round the outer edge of slime dam - - - - -	2	23.60	10	1.90
4. Old tailings - - - - -	3	17.60	7	2.24
5. Recent tailings - - - - -	3	17.60	5	14.40
6. Recent barrel tailings - - -	37	16.96	33	14.40”

The Ballarat Reef bears N. 37° W., and has a westerly dip of 70°. From the surface down to a few feet below the water-level (200 feet) the quartz has yielded 1½ oz. per ton; and from thence to a depth of 260 feet 10 to 11 dwts. only. The average thickness of the reef is about three feet.

The Chrysolite Reef has a strike of N. 35° W., and a westerly dip of 75° to 80°. It varies in thickness from eighteen inches to two feet; and the average yield near the surface was 1 oz. per ton, decreasing to a depth of 150 feet, where it gave only a few pennyweights.

The Western Reef bears N. 35° to 40° W., and is nearly vertical; in some parts slightly inclining eastwards. The average thickness is about five feet. The yield of gold increased with the depth. At the depth of 100 feet, and for some distance higher up it gave from 1 to 1½ dwt. per ton; at 150 feet, 5 dwts.; at 200 feet, 8 dwts.; and thence downwards to 230 feet, 9 dwts. per ton.

The Storm Reef and others present nearly similar features to the above.

From what has been already stated it will be seen that the yield of gold obtained from these reefs, except at points above the water-level, does not give any criterion of the value of the vein-stuff. Below the water-level the quartz is charged with iron and arsenical pyrites, galena, chloro-bromide of silver, &c., and the ordinary processes are insufficient for the extraction of gold from these. Analyses, indeed, unless made on a large scale, and with much care and judgment, are useless for the purpose of testing reefs of this character, and still less are the results got by the miners to be relied on.

The facts collected by Mr. Ulrich are not the less valuable, however. Every one interested in quartz mining should read his careful report, which gives tersely a very complete account of the somewhat remarkable reefs in this locality.

The Jerejaw Reef, at St. Arnaud, according to the reports furnished by the mining surveyor, is traceable for at least three-eighths of a mile; its thickness averages about eighteen inches; and its bearing is S. 29° E., and it is nearly perpendicular. It contains the sulphides of lead and iron; sulphide and carbonate of copper and chromate of iron. There is an elvan lying flatly across it. Twenty-four tons of quartz gave 72 ozs. 10 dwts.; and another parcel of 20 tons yielded 20 ozs. of gold. Fine specimens taken from this reef were exhibited in the Intercolonial Exhibition.

The more important reefs in the Dunolly Division are as follows:—From the Burnt Creek diggings north-westerly towards Mount Moliagul—Garibaldi, Windmill

Bet-Bet, Murphy, Cheshire, Consolation, Tyres, Slaughter Hill, Belgian, Perseverance, Paterson's, Harvest Home, Pensum, Pioneer, Bealiba, Exhibition, Arrandale, Arcadian, Christmas, Bulldog, Hogarth, Queen's, Black, Wayman's, Jones's, Slaty, Sheoak, and Nuggety Point reefs. From Dunolly north-easterly towards the range forming the basin of the Bullabul Creek—Anglesey, Canadian, Kangaroo, American, Baker's, Great Western, Needful, Poverty, Jim Crow, Victoria, Sabbath, Specimen, Chisholm's, Irvine's, Woolshed, Doubtful, Tarnagulla, Corfu, German, Montebello, Watt's, Maiden, Hard-up, Hellas, New Chum, and Antrim reefs.

All these reefs have been opened, and some of them have been very rich. The famous Poverty Reef, from which great quantities of gold have been got, is similar in its formation to the greater number of reefs in this division. The lode appears to be much faulted, and to occur in blocks thick in the middle and tapering towards each end, which are found generally overlapping each other, with from a few inches to several feet of schistose casing between the points of overlap. In working out a block, the commencement of the next block is found to the left or right, and sometimes underneath; so that in proceeding downwards the reef appears to run out in places, but is easily traced towards some other block if the leaders or small veins be followed.* In depth the quartz is hard and flinty, and yields about $2\frac{1}{2}$ ozs. per ton. In the upper levels, where the quartz is porous, the yield was 6 ozs. per ton.

Some of the reefs in this division have been opened to great depths, and the quartz in the deeper levels is in some places very rich.

Stubbs' Reef yielded as much as 10 ozs. per ton, Hellas Reef $9\frac{1}{2}$ ozs. per ton, and Corfu Reef 20 ozs. per ton. The claims on Specimen Reef have given $3\frac{1}{2}$ ozs. to 5 ozs. per ton; and others good stone in large quantities. As soon as the claims get down as far as 150 or 200 feet good machinery becomes necessary; but for small areas this cannot be obtained, and consequently valuable mines have to be abandoned. The miners abandon them with the less reluctance in a locality where so many valuable reefs crop out on the surface.

Some very beautiful specimens of gold in lumps and crystals, taken from the Poverty Reef, were exhibited by Messrs. Beynon and Company, in Dublin.

In the Korong Division the reefs are numerous, and in some instances very rich. At Jericho there are Paterson's, Milkman's, Black's, Phillip's, Adelaide, Frenchman's, and German Reef; at Kingower—Union, Bonaccord, Walker's, Hope, and some other reefs; at Sunday Morning Hill—Sunday Morning Reef; at Korong—Black's, Lane's, Specimen, Garibaldi, Lincoln, Solway, and several other reefs; and at Old and New Inglewood, quite a network of auriferous veins. These—numbering perhaps fifty—have been wrought with good results. An interesting and valuable record of the operations of the miners at Inglewood was published some two years ago by Mr. Thomas Howard.† His little volume shows that, besides possessing literary ability, the author is able also to comprehend and to explain many of the phenomena which present themselves in vein mining.

From the summary of results in this work, the following facts are taken:—

The Jersey Reef has produced an average of nearly $1\frac{1}{2}$ oz. per ton.

The Maxwell Reef has given 1 oz. 9 dwts. per ton.

From the Morning Star the average has been 1 oz. 7 dwts. per ton.

* *Mining Surveyors' Reports*, p. 220, vol. II.

† History of the Inglewood Reefs, from their discovery in 1859 to 1866, by Thomas Howard. Printed and published at the *Advertiser* Office, Brooke street, Inglewood.

According to the imperfect records obtainable, Buchanan's Reef has yielded 1 oz. $5\frac{1}{2}$ dwts. per ton. It is said that immense quantities of rich stone could be got from this vein.

The Godwin Reef—lying to the west of the Exhibition Reef—has given $1\frac{1}{2}$ oz. to the ton; the Reality Reef nearly 1 oz. per ton; the Leicester Reef $18\frac{1}{2}$ dwts. per ton; March Reef, $17\frac{1}{2}$ dwts. per ton; the Old Inglewood Reef, 14 dwts. 8 grs. per ton, but some parcels have yielded as high as 9 ozs. per ton; the Poverty Reef, 13 dwts. 8 grs. per ton, but some parts of the lode opened by Messrs. Baragwanath and Samuel were very rich; the Yeldham Reef, 13 dwts. 2 grs. per ton; the Daly Reef, 10 dwts. per ton; and the Kentish, Dreadnought, and Bendigo Reefs, respectively 10 dwts., 9 dwts. 14 grs., and 5 dwts. 13 grs. per ton.

Some of the yields from these reefs were very high. Ninety-three tons of stone taken from the Old Inglewood Reef gave 825 ozs. of gold; 1,268 tons from the Morning Star Reef produced 3,231 ozs. 9 dwts. 20 grs.; and eight crushings from the Columbian Reef gave $11\frac{1}{2}$ ozs. to the ton.

In the Mining District of Ararat the reefs are few, and, except at Pleasant Creek and Moyston, not very important.

Captain Couchman, the chief mining surveyor, thus describes the reefs at Pleasant Creek:—

"Pleasant Creek, the westernmost goldfield in Victoria, is situated about twelve miles east of the Grampian Ranges, and it may be fairly classed at the present time among the principal quartz mining centres of the colony.

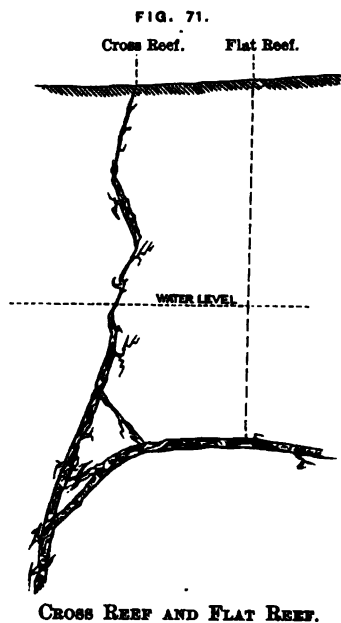
"The most important quartz reefs yet opened on this field are situated at or in the vicinity of a township of fast-growing importance, named The Reefs. They are known as the Cross, the Cross Flat or Sloan's Reef, the Old Scotchman's, Scotchman's Flat, New Scotchman's, Wonga-Wonga, Perthshire, and the Waterloo Reefs; there are, however, many others in the locality, such as the Wexford, Nowhere, Newchum, Moonlight, Prendergast, Caledonian, Nuggety, Brumagem, Pearce's, Bonny Dundee, Ross-shire, Flying Doe, Durham, and Manners-Sutton Reefs.

"Some of the reefs have been remarkable for their good average yields of gold, and the extraordinary features they present in their numerous faults, contortions, and peculiar foldings, and their detached and broken masses. These will be illustrated in the accompanying sketch sections and descriptions, prepared from drawings and other information furnished by Mr. D'Alton, the Government local mining surveyor.

"Figs. 71 and 72 represent portions of the Cross and Cross Flat Reefs at the points of crossing shown by section lines CD and EF on the plan of the locality. (See Deep Leads, Pleasant Creek.)

"The vein-stone of the Cross Reef is said to be generally laminated, with a casing from six to eight inches in thickness on the hanging wall. Where the stone does not occur in the form of layers it is poor. Iron and arsenical pyrites are very abundant in

2 x 2



some parts of the reef. These minerals in some places have been found in small crystalline masses accompanying gold. This was especially the case at the junction of the Flat Reef. The richest stone taken from the Cross Reef was situated at this junction, and at a depth from the surface somewhat above the original water-level. It may be here mentioned that it has been found by experience in other mining countries that at the junction of ore-lodes the character of the mineral always changes, and generally for the better.

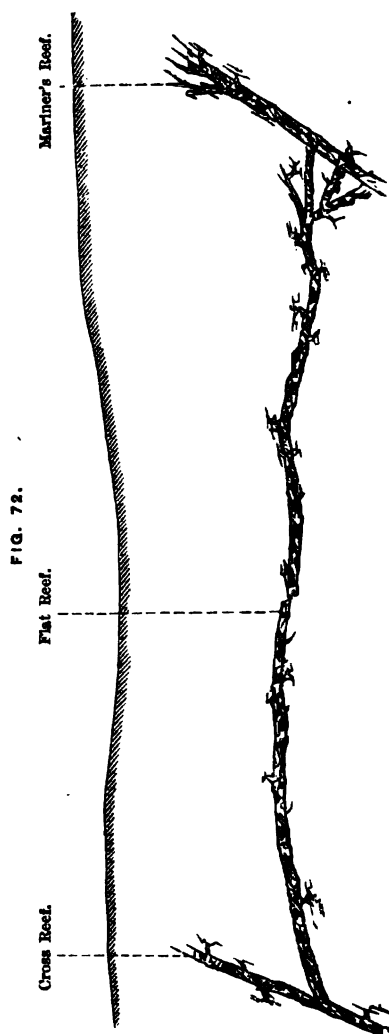
"The Cross Flat Reef consists of compact white quartz, with no casing on either side. The gold is coarse and unequally distributed, and it appears to be chiefly confined to regular spaces, somewhat like bands, passing through the reef in a northerly direction. In some of these auriferous spaces the quartz has been found to average 7 ozs. of gold per ton, but on the outside of them the greater portion of the stone has not yielded more than 3 dwts. or 4 dwts. per ton.

"The Cross and Flat Reefs have hitherto varied in thickness, the former from three inches to twenty-four feet, and the latter from two to eight feet, with a general average thickness of about six feet. The workings of the several mines are in operation at depths from the surface varying from 480 to 560 feet, and they are now being prosecuted vigorously, and generally with very profitable results. Up to the present time the claims have been chiefly drained by the Cross Reef Pumping Company, who have sunk the deepest shaft on the line of reef; the flow of water is, however, very inconsiderable. The horse-whim is the principal motive power used for raising quartz. Only three steam engines have as yet been introduced for this purpose. Steam machinery must, however, gradually displace the whims as the workings are extended to greater depths.

"Fig. 73 represents the Old Scotchman's and Scotchman's Flat Reefs, on the line G.H., shown on the plan of the locality.

"The Old Scotchman's Reef consists of dense white quartz, with brown and bluish ferruginous veins, and the gold is found distributed in the faces of the stone in small particles or nuggets, and running in strings, with large patches of non-auriferous quartz intervening. The average yield of gold has been about 12 dwts. per ton, and the thickness of the reef varies from two to four feet, the average being about two feet six inches.

"The Scotchman's Flat Reef is situated below the water-level. It is from one



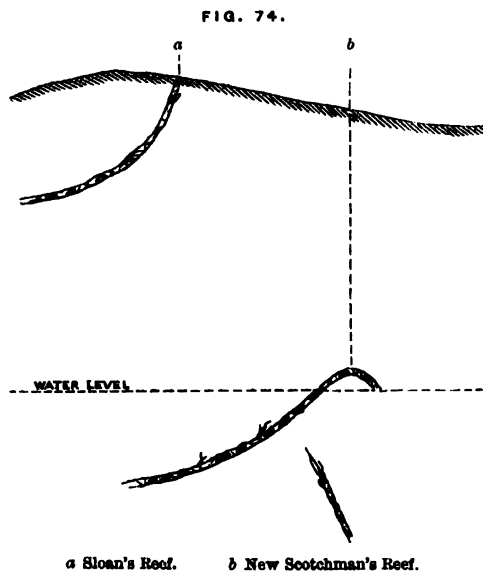
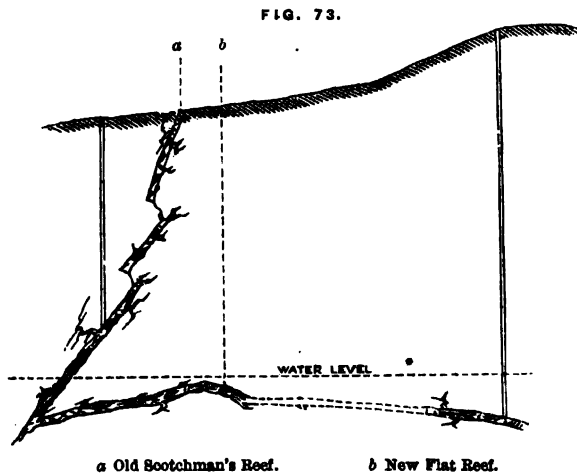
foot six inches to nine feet thick, and the average thickness is four feet. The inequalities in the thickness are chiefly confined to the foot wall. The gold in this reef is fine and laminated, and very equally distributed in the bluish veins which intersect the quartz. It rarely occurs in the compact stone. The average yield has been about 2 ozs. 2 dwts. per ton. Pyrites is not very abundant. The enclosing sedimentary rock is a dark-blue schist of medium hardness.

"The workings on these reefs have been carried to depths varying in the several claims from 280 to 390 feet, and similar means are adopted for raising quartz to those in use at the Cross and Cross Flat Reefs. Horse-whims are the chief motive power. Only two steam engines have been erected up to the present time, one for pumping and winding, and the other for winding only.

"Fig. 74 is a cross-section of Sloan's and New Scotchman's Reefs, on the line JK, on the plan of locality.

"Sloan's Reef has been found to be a continuation of the Cross Flat Reef at a higher level, and it has been worked from the surface to a depth of 200 feet in places. At that portion of the reef shown in the above section, the quartz is of a dark color, and is intersected with dark-brown ferruginous veins. The gold is lodged in small hollows or cavities in the faces of the stone, it is fine and powdery, and so loose that it can easily be shaken out of these cavities. The auriferous quartz occurs in patches, and some of these have been very rich, and have yielded as much as 160 ozs. of gold to the ton; the average yield, however, has been about 15 dwts. per ton. The hanging wall of this reef has a soft casing about nine inches thick, but no gold has been found in it.

"The mineral of the New Scotchman's Reef is so very similar in appearance to that of the Scotchman's Flat Reef, that it need not be specially described. The lode has varied in thickness from four to thirty-seven feet; it dips northerly, and is supposed to underlie Sloan's Reef. The workings vary in depth from 280 to 390 feet, and the average yield of gold in the quartz has been about 2 ozs. 2 dwts. per ton.



"Another lode has just been discovered at a depth of ninety feet below the New Scotchman's Reef, as shown in the section. It is probably a faulted continuation of the same reef.

"Fig. 75 represents the Perthshire and other disjointed reefs on the line LM, on the plan of the locality.

"Considerable disturbance seems to have taken place in the reefs and sedimentary rocks shown in this section; the former, as may be seen, are very numerous, greatly broken, and very irregular in their courses.

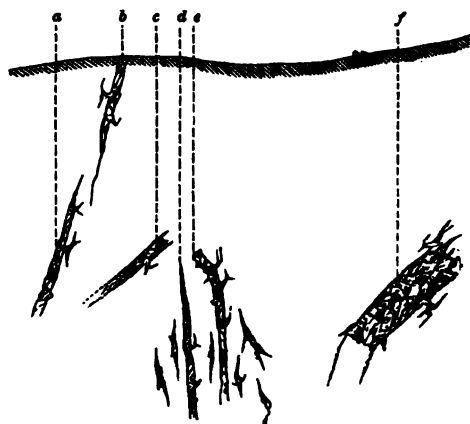
"The principal quartz vein, the Perthshire, has been found to be from twenty to thirty-three feet thick; it has been worked at depths varying from 200 to 250 feet from the surface, but a good deal of it consists of non-auriferous stone; the average yield of gold has been about 12 dwts. per ton; and the bounding sedimentary rock is a light-brown sandstone.

"The local mining surveyor mentions that the general character of the stone in the Pleasant Creek Reefs is hard and compact, and it contains a great deal of iron and arsenical pyrites, which is sometimes found in small masses combined with gold of a crystalline form. The western sides of the quartz reefs have been generally found the most auriferous, the gold being usually distributed in the brown iron ore veins, and mullock faces of the stone. Those reefs which dip to the westward or north-westward were at first considered to be the only payable ones, but latterly this view has proved to be erroneous in several instances. The Wonga-Wonga Reef may be named as one of the exceptions to the rule, as the gold it contains is found to be distributed in the solid stone, and not in the ferruginous veins. This reef is, however, a recent discovery, and has not yet been tested to any great depth, and it is therefore possible that the dip may change to the westward as the workings are carried downwards.

"It is remarkable that the strike of the quartz veins in the vicinity of The Reefs township does not conform to any one general direction, as is usually found to be the case on other goldfields. Their courses trend to almost every point of the compass, and sometimes cross each other nearly at right angles; and further, the vein-stone in reefs that are immediately contiguous, presents points of great difference, both as regards the quartz and the mode in which the gold occurs in it. It is also evident, from the broken and contorted character of the quartz veins and the adjacent sedimentary rocks, that great changes have taken place in the strata since the original formation of some of these veins. If the whole of these circumstances are taken into consideration, they appear to me to offer strong presumptive evidence that the reefs have been formed under different conditions, and perhaps at widely separated periods.

"Folded or contorted gold-bearing reefs, thus of the other goldfields of the colony; but the of what seems to be two distinct lodes diverging

FIG. 75.



- | | |
|-----------------------------|-----------------------|
| a Lower Scotchman's Reef. | d Broken Reef. |
| b Scotchman's Surface Reef. | e Prendergast's Reef. |
| c Prince of Wales Reef. | f Perthshire Reef. |



are found on some peculiar occurrence from each other, as

shown in the cross sections of the Cross and Flat Reefs, and of the Scotchman's and Scotchman's Flat Reefs, has not been recorded in any other district.

"So far as we know at present, the Cross and Flat Reefs terminate at the south-east end, and the Scotchman's and Scotchman's Flat Reefs at the north-west end, at the points shown on the plan of locality; and from the great similarity of the mode of divergence in both these double reefs, and their very extraordinary formation, it appears to be just probable that they were originally conjoined in one common line, and subsequently displaced in a lateral direction, by a great faulting and heaving of the strata. Mining operations are not yet, however, sufficiently advanced to determine this point with any degree of certainty.

"With regard to the Flat Reef, I think there can be little doubt that its present dip is due to a folding of the strata subsequent to its formation, as the bedding planes of the schists have been observed by Mr. D'Alton, the mining surveyor of the division, to conform very nearly to the underlie of the flattened quartz vein.

"If this theory be correct, I am inclined to be of opinion that the Cross Reef is a lode of later formation, occurring side by side with the Flat Reef, up to the point where the latter has folded over, and thence following a fissure in the schist rock running upwards, along the line of least resistance towards the surface. It may be remarked in favor of this view that the quartz is of a distinctive character in each reef, and although I believe the attention of the miners has not been specially directed to the varying character of the quartz below the junction of the two reefs, yet well defined and distinct features have been sometimes observed, as indicative of the existence of two separate lodes lying side by side. It may also be mentioned that, in places below the junction of the two reefs, the quartz on the underlying portion of what I suppose to be the older reef is composed of small sharp angular fragments, cemented together by carbonate of lime, and forming a tough compact mass, from nine to twelve inches thick, in close connection with the main lode: when broken out from the reef, this stone immediately loses its cohesion, and falls into innumerable fragments. I can only account for this singular character of the mineral by assuming that the quartz was originally broken by the influence of a severe crushing pressure, the result probably of a disturbance of the strata, and that the drainage water, charged with a solution of lime, then percolated through it and cemented the whole mass together as I have described.*

"The presence of lime in the schist formations is of exceedingly rare occurrence; but in this case there can be no doubt of its existence, as small streams of water draining over the side walls and slopes of a drive, contiguous to the place where the broken quartz is found, are now depositing pure carbonate of lime on the rocks over which they flow.

"One of the most striking features in the mining operations at Pleasant Creek is the large number of shafts and machines in use for raising quartz on the principal reefs. Nearly all the claims were originally taken up under the District Mining Board

* This goldfield lies on the southern marge of the Murray tertiaries, and it is probable that the lime has been derived from the shell beds. If this be the origin of this mineral, it affords evidence, corroborative of the statement in another part of this paper, relative to the changes effected by denudation in quite recent times. It is probable (having regard to the levels) that the Murray tertiaries once encroached on and covered the country wherein this goldfield is situate. And the denudation, it is clear, did not cease when the tertiaries were removed. The *leads* have been cut into and carried away, and the eroding action still continues.—R.B.S.

Bye-laws, and they are often of very small extent, many of them being not more than from 60 to 100 feet in length along the line of reef; they are also in most instances held up to the present time by separate companies, who carry on their workings independently of each other, from a shaft on each claim. Many of the shafts are now down to depths varying from 300 to 560 feet from the surface; and it must be obvious to anyone acquainted with the subject, that the workings could be prosecuted in a much more systematic and economical manner, if several of the smaller claims were amalgamated and worked from one principal shaft, with adequate machinery and under one management."

Mr. James Daly, the warden at Ararat, has furnished the following statement relative to the reefs at Moyston:—In Campbell's Reef North the depth of the water-line is sixty feet; the deepest shaft is 296 feet; the width of the vein varies from three inches to six feet; and the average yield is 15 dwts. 12 grs. Above the water-line the quartz is slaty but solid, and contains pyrites and other sulphides. In Campbell's Reef South the water-level is found at a depth of ninety feet; the deepest shaft is 520 feet; the vein is of the same thickness and character as in the north mine, and the yield is about 1 oz. per ton. There is a decided improvement in the mine at the lower depth.

In the Southern Cross the water-line is seventy-four feet from the surface; the deepest shaft is 420 feet; the vein varies from two inches to four feet in thickness; and the average yield is 14 dwts. per ton. The character of the vein is the same as in the other mines.

There are about 4,000 feet of reef already partially explored.

In the Mining District of Gippsland* (formerly a part of the Beechworth District), auriferous quartz veins are found cropping out on the surface in nearly every part of the palæozoic areas. The more important localities are Crooked River and Stringer's Creek, where very rich stone has been got.

Quite down to the sea-coast on the southern slopes of Hoddle's Range the veins have been opened with more or less success; and in the future we may hope to see a great number of miners employed in vein mining in this district.

From the sources of the River Latrobe on the west to the Bendoc on the east, a great number of reefs have been tested, and gold is found in all of them.

The operations of the miners at Crooked River are important and extensive; and when there is better and more rapid communication with the metropolis claims on this goldfield will be eagerly sought by capitalists. From reports furnished by Mr. Arthur Walker, mining surveyor, the following descriptions are taken:—

The steep rocky ranges running down to the Crooked River and its tributaries the Good-luck, Black Snake, and Good Hope Creeks, are composed of palæozoic rocks having generally a north-westerly strike, and the auriferous veins run nearly in the same direction.

Although the reefs contain a fair amount of gold, the ruggedness of the country, the expenses of raising quartz—due mainly to the circumstance that the veins are thin—the difficulty and cost of conveying the vein-stone to the crushing machines, and the high price of every kind of mining material, have hitherto prevented the miners from reaping such profits as, judging from the character of the stone, they might at first have expected.

* Gippsland was made a mining district by an Order in Council dated 17th December, 1866.

The following notes on the reefs at Crooked River give concisely the leading features of them.

The Morning Star Reef has a strike on the surface of N. 80° E., and at a depth of forty feet N. 70° W. The dip is from 85° to 90° W. One crushing of ten tons gave an average of 2 dwts. per ton only, and the mine was abandoned.

The Royal Saxon East has a strike of N. 71° W., and a dip of 90°. The depth of the shaft is 150 feet, and the depth of the water-line 130 feet. The average yield has been 5 ozs. per ton. The vein varies in thickness from one to fifteen inches, and is composed of finely laminated quartz with veins of oxyd of iron and arsenical pyrites.

The St. Leger Reef has a strike of N. 70° W. It is probably a continuation of the Royal Saxon Reef, the intervening ground being broken up by sandstone bars. It has crushed from 15 dwts. to 2 ozs. per ton.

The Teutonic Reef runs out towards the east and west. The depth of the shaft is 130 feet, and the water-level is found at 110 feet. The average yield has been 1½ oz. per ton.

In the Royal Saxon West the reef bears N. 75° W., and the depth of the shaft is 75 feet. The thickness of the vein varies from two to twelve inches. One small parcel of stone yielded 11 ozs. per ton.

In the Italian, Little Dorrit, and Union shafts the vein varies in the strike from N. 60° W. to N. 70° W., and consists of an irregular mass of leaders, with here and there rich patches of gold. The thickness of the veins or leaders varies from half an inch to ten inches.

Fig. 76 shows a section of the vein as cut in the Italian Company's shaft.

In the Prince of Wales, which bears N. 72° W., rich specimens were found on the surface. The quartz, which is patchy, varies in thickness from four to eighteen inches.

In the Rose of Australia they have found an irregular mass of leaders, running generally N. 25° E.

The strike of the Glenora is N. 70° W. The thickness of the vein from ten to eighteen inches; and the average yield 1 oz. 5 dwts., at a depth of eighty feet.

The Magenta runs N. 69° W. The thickness of the vein is from six to fifteen inches. The depth of shaft ninety feet; and the average yield 3 ozs. per ton. The gold is found principally in the casing of the vein, and in large patches of arsenical pyrites in the quartz.

The Great Western has a strike of N. 70° W., and the average thickness of the vein is twelve inches. The yield has been 18 dwts. per ton.

The Uncle Tom and Collingwood run respectively N. 84° E., and N. 56° W.; and the thickness of the reefs is ten inches.

The Frank Walsh has a strike of N. 68° W., and the vein is eighteen inches in thickness. The average yield is 2 ozs. 14 dwts., and the depth of workings eighty feet. About 3,000 tons of stone are ready to be raised.

FIG. 76.



Fig. 77 shows a section of the vein as cut in the shaft.

The Mountaineer Company's vein runs N. 75° W., and is from four to five feet in thickness on the surface, and from eight to ten feet in thickness in the tunnel. Ten tons gave 5 dwts. per ton. The quartz is white and barren looking, and shows but little iron pyrites, and no arsenical pyrites.

The strike of the Brother Jonathan is N. 58° W., and the thickness of the vein from eighteen inches to two feet. The average yield is 2 ozs. per ton.

The Abe Lincoln runs N. 70° W. It has an average width of twelve inches, and has yielded 15 dwts. per ton. The quartz is quite full of arsenical pyrites.

On the Luck's-All Spur three reefs have been opened—one bearing N. 70° W., about fifteen inches in thickness; another N.E., about eighteen inches (average yield $1\frac{1}{2}$ oz. per ton); and another bearing nearly north. The second reef is very rich in arsenical pyrites, pieces weighing from 10 to 12 lbs. being often found in the casing.

Fig. 78 shows a section of this reef.

In the Jeff. Davis two distinct reefs are found intersecting each other, the one bearing N. 3° W., and the other N. 30° E. The latter has been worked most, and appears to run out towards the north and south.

The Pioneer runs N. 72° W.

The average thickness of the vein is one foot. It appears to get poor below the water-level, and to run out in the southern end of the claim.

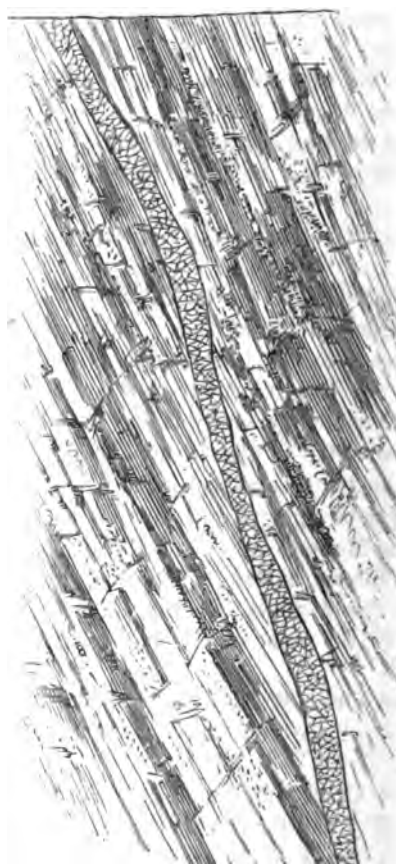
From the Jeff. Davis Reef 360 tons of quartz were taken from various depths, which yielded 4 ozs. 17 dwts. $18\frac{3}{4}$ grs. per ton; and from the Pioneer, Moonlight, and Teutonia Reefs large quantities of stone gave from 1 oz. 4 dwts. to 5 ozs. per ton.

It is not possible to give the dip of these reefs with accuracy; but it is sufficient to say that they are nearly perpendicular everywhere.

FIG. 77.



FIG. 78.

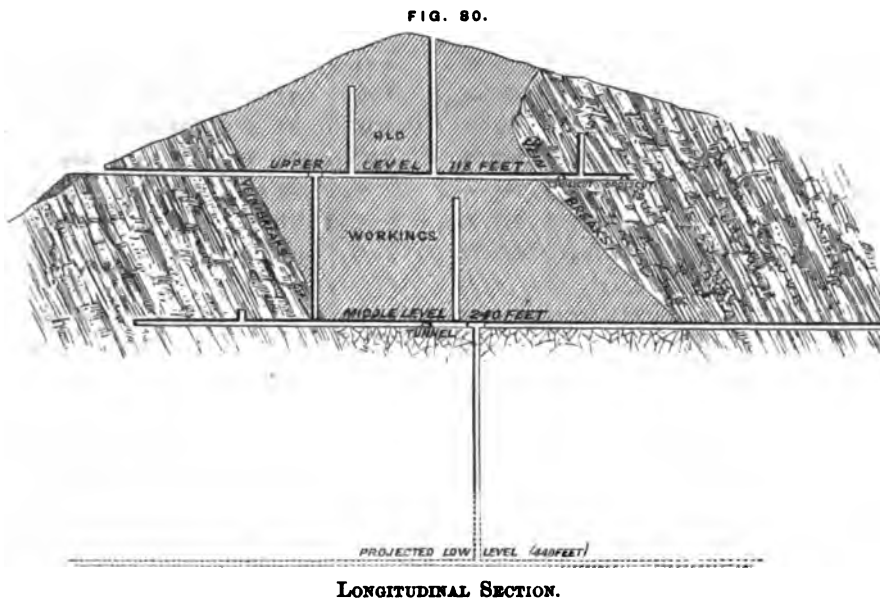
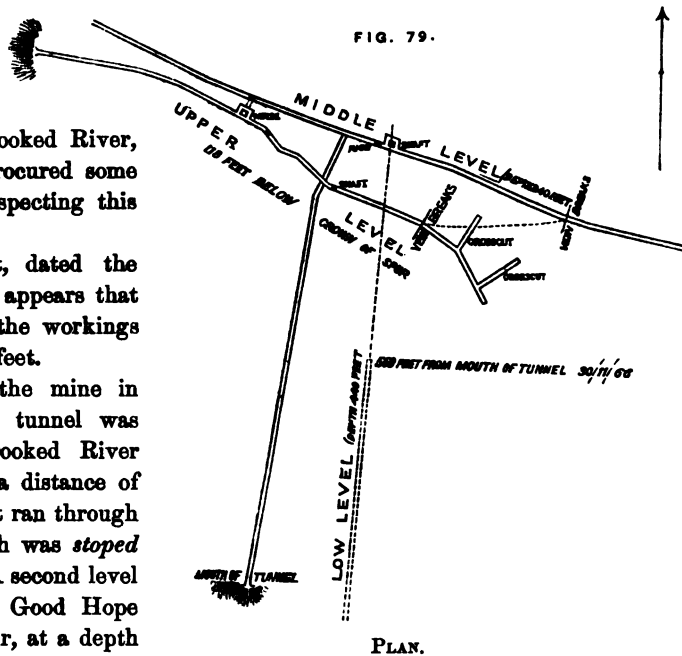


In the Good Hope Mine (see Fig. 79 and Fig. 80) the quartz is of a bluish color, laminated, and full of arsenical pyrites. The depth of the lowest tunnel is about 460 feet from the surface, and at this level rich quartz has been taken out.

Mr. Hart, the warden's clerk at Crooked River, at my request has procured some useful information respecting this mine.

From his report, dated the 10th March, 1868, it appears that the lowest depth of the workings at that time was 440 feet.

When opening the mine in the first instance, a tunnel was driven from the Crooked River side of the spur for a distance of 450 feet, and 280 feet ran through payable ground, which was *stoped out* to the surface. A second level was put in from the Good Hope Creek side of the spur, at a depth of 120 feet below the first tunnel, and a winze was sunk to connect the two levels. For a distance of 150 feet westwards from the winze the drive went through barren quartz and broken ground; but



on the east the drive penetrated about 200 feet of payable ground, and that was *stoped out* to the upper level. The third or lower level is also from the Good Hope Creek

side of the spur; and has been driven a distance of 767 feet, at the end of which a cross-drive has been put away for a distance of forty-six feet westwards to meet a winze, 185 feet in depth, which has been sunk to connect the middle and lower levels. This drive passed through barren ground. On the east side the cross-drive is now in a distance of 135 feet, and is being driven further. For the first eighty feet it passed through very rich quartz, yielding about 4 ozs. per ton, and for fifty feet it went through inferior stone. The vein at this part is again showing well, and is about six inches in width.

The stopes between the lower and middle levels are now in full work, and the width of the reef varies from three to fourteen inches. Nine or ten inches may be said to be the average.

Partly on level tramways, where the trucks are pushed by men, and partly by a self-acting incline, the quartz is brought to the surface to be crushed.

The following table gives accurately the results of the operations at this mine:—

RETURN OF CRUSHINGS AT THE GOOD HOPE MINE, CROOKED RIVER, FROM
NOVEMBER 6TH, 1867, to FEBRUARY 27TH, 1868.

Date.	Amount of Quartz crushed.	Amalgam.					Gold.
		Beds.	Boxes.	Blankets.	Alloy.	Total.	
1867.	Tons.	ozs. dwts.	ozs. dwts.	ozs. dwts.	ozs. dwts.	ozs. dwts.	ozs. dwts. gra.
November 6	33	84 7	88 15	49 7	35 0	257 9	104 19 0
" 23	59	160 19	276 17	81 12	32 0	551 8	254 0 0
December 2	From above	- -	- -	31 0	10 10	41 10	17 0 0
" 6	48	142 0	178 12	57 12	36 0	414 4	187 15 0
" 19	67	203 0	202 16	102 12	30 10	538 18	228 13 6
" 31	42	55 10	95 12	34 0	28 0	213 2	127 2 0
1868.							
January 11	71	96 0	300 2	89 15	38 0	523 17	229 7 0
" 16	55	87 18	296 0	92 17	49 19	526 14	233 4 0
" 23	63	156 0	351 4	109 5	52 5	668 14	306 0 0
" 30	61	79 5	265 12	64 10	18 8	427 15	209 1 0
February 13	65	95 0	301 0	75 18	12 10	484 8	215 9 0
" 20	66	140 15	346 0	78 0	27 0	591 15	282 1 0
" 27	67	200 10	382 5	87 0	26 0	695 15	328 0 0
	—	—	—	—	—	—	130 17 6*
Total	697	- -	- -	- -	- -	- -	2,853 8 12

* From pyrites.

There are twelve stamps and a ten-horse engine. Usually eight heads are worked at once, as the engine is not powerful enough to drive the twelve and to pump at the same time.

The discs are screwed on to the stamp-head shanks, and are raised as the shoe wears; and there is a self-feeding apparatus. The crushed quartz falls over two rows of ripple-boxes, which are charged with 65 lbs. of quicksilver each to the four head of stamps, and the tables are covered with blankets. Those on the upper end of the tables are changed every two hours, and on the lower every four hours, and are

washed by hand. The tailings after leaving these tables pass on to the percussion table invented by Mr. H. A. Thompson.

Several improvements have been made in the crushing apparatus, &c., by Mr. Holme and Mr. Mitchell, the managers of the mine.

The pyrites, &c., are roasted and passed through a Chilian mill.

The machinery is kept working night and day.

About five tons of pyrites remain, which it is estimated will yield 150 ozs. of gold.

The alloy is removed by hand from the top of the quicksilver in the ripple-boxes.

We undoubtedly owe much to the enterprize of our miners and to the skill and industry which are directed to the development of the auriferous quartz veins. There are, however, many things which one having an interest in mining operations would willingly see altered. The too common practice of "picking the eyes out of a mine"—getting out only the richest stone, and leaving moderately good stuff in such a way as to prevent successful operations in the future—should be discontinued. The greed of shareholders often compels the manager to work regardless of the future; and as all that is not actually required at the moment for the payment of wages or the cost of materials is looked upon as profit, and paid away in dividends, it is impossible to keep the mine and the works in a good condition.

Many valuable reefs have been wrought on a wasteful system, and it is questionable whether some steps should not be taken to check it. Yet interference of any kind with private enterprize is so dangerous—there are so many evils contingent on it—that it is not likely the State, even for a good purpose, will depart without the strongest reasons from a salutary principle.

In the pyritous reefs of this colony we have sure sources of wealth; and the invention of Mr. H. A. Thompson, which appears to have given good results at Crooked River, and the discovery of Mr. William Crookes, will each undoubtedly receive a fair trial. By-and-by the method adopted in America, of stacking the pyrites in layers with fuel in quantities sufficient to give rise to decomposition, will be used here, both for the purpose of setting free the gold and for securing the resulting chemical products.

The difficulties which attend the extraction of gold from vein-stones containing large quantities of iron pyrites, sulphide of antimony, and other minerals, are very great. Mercury, when brought in contact with these minerals during the process of trituration, is subdivided into minute globules, which are carried away by the water and lost. Each globule has a film of finely powdered sulphide on its surface, and it will not reunite with the other globules.

Some substances in quite small quantities are sufficient to prevent the action of mercury on gold.

In order to preserve and intensify the amalgamating powers of mercury, Mr. William Crookes, F.R.S., the discoverer of the metal thallium, has introduced the sodium amalgam. Whether or not it possesses all the advantages which are claimed for it is a question on which I am incompetent to give an opinion; but as it is of great moment to the miner to have accurate information as to its properties, Mr. George Foord, F.C.S., the agent in Victoria for the patentee, has been kind enough to furnish, at my request, some notes on the use of sodium amalgam for the extraction of gold and silver from their ores. He writes thus:—

"When the metal sodium is heated in contact with mercury, the metals combine, forming a solid, bluish-white, brittle, and highly crystalline alloy. The combination

is attended with explosions. The resulting alloy crystallizes in beautiful hexagonal prisms, which are often obtained of considerable dimensions. The prisms are in some instances cracked across at regular distances throughout their length, and, what is still more remarkable, they are frequently *hollow*, with occasionally inner tubes or volutes of the amalgam, generally concentric with the external hexagonal shell and connected with the latter, and in fact supported in their place by struts, partitions, and buttresses of amalgam extending from the outer wall of the crystal to the inner tubular lining.

"The application of this sodium amalgam to the purposes of gold and silver extraction was first made by William Crookes, F.R.S., the discoverer of the new metal thallium. Mr. Crookes has made elaborate experiments conducive to the general application of sodium amalgamation to gold and silver extraction, and effective modes of operating are described in detail in the specifications of the two patents which he has obtained for this colony.

"When sodium amalgam is placed in contact with water, the latter is decomposed with evolution of hydrogen; an alkaline solution and free mercury remain as products of this action.

"Sulphides and many other metallic minerals, placed in contact with the amalgam, are rapidly decomposed; but, notwithstanding this chemical aspect of the question, the chief practical value of the sodium compounds, regarded in reference to gold and silver extraction, resides rather in their mechanical than in their chemical properties.

"Mercury, to which a very small proportion (an almost infinitesimal dose) of sodium amalgam has been added, possesses properties widely different from those of pure mercury. It has become more mobile; it is obviously far more greedy of gold; it readily amalgamates with iron and steel surfaces, and it as readily covers platinum. Mercury, 'floured' or rendered 'sick' or sluggish, by impurities derived from the ore, is at once restored to full activity and perfect brilliancy by the addition of a small dose of sodium amalgam.

"The successful use of the sodium amalgam requires certain precautions, the general character of which may be learned from the following observations:—Being more mobile, the mercury, charged with sodium, will be more liable to escape from the mill; the use of higher ripples, &c., will in most cases ensure success in this respect. Continued attention to the tailings (especially in the first instance, while adapting the sodium method to the peculiar construction of the mill), so as to ascertain their freedom from mercury, will be imperatively necessary. If mercury is lost, gold will be also lost; for the sodium mercury will certainly hold even the finest gold, selecting it in the most searching manner from the crushed stone. Thus the mobility and strong retentive power for the gold (most valuable properties in themselves) may actually, by mismanagement, conduce to the loss of gold.

"The proportion of amalgam to be added to the mercury differs according to the nature of the ores, and according to other conditions, such as those which concern the structure and rate of working of the mill. For effective use, only a very small proportion of the sodium compound is required. One part of the sodium amalgam A of Mr. Crooke's patent, in fifty parts of pure mercury (employing a little heat for its solution in the latter), has been recommended as an average proportion; but the efficiency of the sodium will, I believe, be obtained in most cases by the use of the amalgam in proportions far lower than the above. The too lavish use of the sodium compound is an error to which beginners are especially liable, and it is an error by which the results are sensibly impaired. No better rule can be offered than that which suggests the use of *too little*, rather than *too much*, sodium. From time to

time, as the sodium is expended, a fresh charge must be added. The time for the fresh addition is purely a matter of practical experience, to be determined in each case; and which, when once carefully determined, need cause no further trouble. As long as the mill works well, and without escape of mercury with the tailings, it may be generally inferred that the sodium is doing its work; but examination of the mercury itself will, after a slight experience, show whether the sodium is or is not exhausted; and comparisons of yield, and, above all things, assay of the tailings, will afford a full interpretation of the comparative success of the operations.

"Owing to the inconvenient and dangerous explosions which accompany the manufacture of the sodium amalgams, the miner finds it more convenient to purchase the amalgams prepared of definite strength, and ready for immediate addition to his mercury, in preference to handling the sodium in its uncombined form. The amalgams are safe for carriage, and they may be handled with far less precaution than would be required in the case of employing the uncombined sodium.

"Some delay in the introduction of the sodium method has been experienced. I have, however, recently received from the patentee the full agency for the colonies; and I am now pushing forward arrangements for the supply, and for development of the general use of the method.

"Hitherto the quantity of the amalgam used has not been great: about 4 or 5 cwt. has passed through my hands to the consumer during the last six months. A good trade appears to be now rapidly opening out, and it is reasonable to expect that the consumption of sodium amalgams will very shortly amount to considerable quantities.

"Hitherto nearly all the real inventions concerning the methods of gold extraction have been directed to improvements of the several kinds of machinery employed. Crooke's method differs from these in affording a more powerful agent for collecting and holding the gold, applicable to all kinds of machinery. The improved properties which are imparted to the mercury, by addition of sodium, are most palpable, and, indeed, easily demonstrable. The method, involving a new power, requires a little caution, and some painstaking, for its control. All new powers thus economically applied require this; but in reference to the applicability of the sodium amalgamation, I believe that there are no grave difficulties such as might retard its general adoption. The best results will, I opine, be obtained where the most care and intelligence are brought to bear upon its adoption; and when the method is once fairly established in use in the mill it will afford better results, often with a saving of trouble, than those obtainable by any of the old methods of treatment."

Mr. Foord very properly insists on the necessity for frequent assay of the tailings. This is too often neglected by mill-owners; and yet it is the only safe method of determining whether or not the operations they are conducting are really effective.



Cement.



On all the goldfields there is found, overlying the bed-rock—in some places touching it, and in others a few inches or a few feet above it—a stratum of very ferruginous conglomerate, composed of rounded pebbles of quartz, angular fragments of the same rock, and small pieces of schist. At Sandhurst, Maryborough, Castlemaine, in some part of the Beechworth District, and at Ararat, it is highly auriferous; but the miners fail to extract the gold from it by the ordinary processes of sluicing and washing. In places this stratum is very hard, and it is necessary to blast it to get it out.

It is not possible to give any accurate account of the yield of gold per ton in reference to very large quantities, because, where it is sent to the mills to be crushed, it is mixed up in the returns with the yields from quartz tailings and mullock.

Up to the 31st December, 1867, information has been received relative to the yield of gold from 798,026 $\frac{1}{10}$ tons of quartz tailings, mullock, cement, &c. The total produce was 172,252 ozs. 16 dwts. of gold, and the average per ton 4 dwts. 7·6 grs.

At Ballaarat, cement is found near the junction of Esmond's Lead with the Eureka gutter. Mr. Cowan states that the depth of sinking is 170 feet. It is found in a sort of basin, at the height of about forty feet above the level of the Eureka gutter, and is separated from the gutter by a bar or reef of clay-slate. The thickness of the layer of cement is from two to eight feet, and it occurs as a ferruginous dark-brown mass, being a mixture of quartz boulders held together by cement. It lies upon a schist reef, which is deeply colored with oxyd of iron to a considerable depth. The machinery used by the Eureka Company, in 1861, consisted of a battery of twelve stamps, worked by a sixteen horse-power engine, and the company was composed of twelve men. They were able to raise and crush 120 tons per week with eight stamps.

The company crushed a large quantity of the *débris* found upon the surface, which, though it did not yield so large a return per ton as the solid mass, was found advantageous to work, in consequence of the facility with which it was obtained. A very large quantity of this *débris* is found, in some places to the depth of nearly fourteen feet. In some of the shafts nearer the gutter a similar formation is found to occur, with the difference that in the deep ground a layer of washdirt from three to six feet in depth lies between the cement and the schist reef. The average yield of gold from the cement was 5 dwts. per ton; but there is no doubt that a larger yield could have been obtained with better machinery.

The Pennyweight Cement Company got 4 dwts. per ton from the same kind of stuff.*

Subsequently it was found, from an assay made of the tailings, that 17 grs. of gold were to be obtained from 130 lbs. of crushed quartz, showing conclusively that the gold-saving appliances were defective.

At the Little Hard Hill in the No. 4 Division of the Ballarat District, cement was found generally in patches all over the hill, at a depth of ten and fifteen feet from the surface, and immediately overlying the pipeclay bottom. As much as 2 ozs. per ton were obtained by burning and hand pounding, and by crushing.†

A large quantity of cement is also found at Whim Holes and at Golden Point, which has given profitable employment to mining companies. As much as 1½ oz. to the machine has been obtained.

At Dreamer's Hill, in the Smythesdale Division, the cement was rich. One party, consisting of four men, crushed four loads of cement and got 184 ozs. of gold; and another party obtained 63 ozs. from fifteen loads. The washdirt with which the cement was intermixed was highly auriferous, and gold was found all the way down from the surface to the cement encrusted on the bottom.‡

The Hard Hill Cement Crushing Company, at Creswick, having a battery of twelve stamps for crushing cement, tailings, &c., and the Enterprise Company, at the same place, for a long period obtained good yields. The result of some of their crushings of cement was for 376½ tons, 270 ozs. 0 dwt. 17 grs., or over 14 dwts. 8 grs. per ton.

At the Woolshed, in the Ovens District, the cement is mixed with oxyd of tin,§ and would well remunerate any company, bringing to the work the necessary machinery and capital and skill.

At Sandhurst, both in the shallow alluviums and the deep leads, cement occurs plentifully, and in some places it is very rich; the gold appearing embedded in it in grains, scales, and small nuggets. It is commonly sent to the mills to be crushed just as quartz is.

In the Waranga Division, at Chinaman's Hill, an immense mass of sandstone and cement was crushed, and the yield was from 6 dwts. to ½ oz. per ton.||

Large quantities of auriferous cement occur in the neighborhood of Rushworth and Waranga; and judging from the results obtained from the crushing of small parcels, it is reasonable to suppose that they will attract the capitalist when money is obtainable at easier rates.

On what is called the Yellow Lead, in the Avoca Division, there is a sudden and deep fall in the bed-rock. It drops about fifteen feet, and there for some distance the washdirt was thick and very rich. In this place the conglomerate has yielded as much as 12 ozs. to the ton.

Much fine gold was got from the cement which occurs at Rocky Flat and Scandinavian Lead, in the Amherst Division, where the rock was subjected to the crushing and amalgamating process. At one time about 100 miners were engaged in raising cement on the outskirts of the old portions of the Scandinavian Lead. The

* Mr. Thomas Cowan, *Mining Surveyors' Reports*, February, 1861, p. 42, vol. III.

† Mr. O'Malley, *Mining Surveyors' Reports*, March, 1861, p. 84, vol. III.

‡ Mr. Lynch, *Mining Surveyors' Reports*, December, 1861, p. 532, vol. III.

§ Mr. Alderdice, *Mining Surveyors' Reports* for June, 1867.

|| *Mining Surveyors' Reports*, December, 1860, p. 364, vol. II.

cement was from eight to twelve inches in thickness, and patches yielded as much as 1 oz. and 2 ozs. to the ton. The yield generally was from 5 to 8 dwts. per ton. The depth of sinking was from forty to fifty feet, and dry.*

At Cochrane's Diggings, in the Dunolly Division, there is a great quantity of cement. In the hills in the neighborhood it overlies the washdirt, and varies in thickness from six inches to two and a-half feet. Gold is found in it everywhere; but it cannot be washed out. It can only be worked profitably under stamps.

In the Deep Lead, at Old Inglewood, five tons of cement yielded 3 ozs. 5 dwts. †

The cement at Blanket Hill, Castlemaine, gave in some places as much as 4 ozs. per ton. ‡

The mining surveyor of the Fryer's Creek Division, in his report for October, 1861, says:—"Cement mining is a large interest in this division, especially around Kangaroo and Vaughan. No less than five steam engines, having an aggregate of ninety-two horse-power, are engaged in crushing cement in these localities. The proprietors are perfectly satisfied with the returns."

Cement at Forty-Foot, in the Ararat Division, gave 6, 7, and 8 ozs. to the ton.

At Four-posts, in the Pleasant Creek Division, one parcel of twenty tons of cement yielded nearly 360 ozs. It occurs in patches.

The same kind of rock occurs at Londonderry, and at one time the miners got as much as 2 ozs. per load from it.

At Silver Shilling Hill, in the Pleasant Creek Division, some patches of cement proved very rich, the average for some time being as high as 2 ozs. and 8 ozs. per ton.

Mr. W. H. Foster, the warden at Sale, who has contributed many interesting facts relative to the mines in his district, says, in his report for May, 1868:—"In the Russell's Creek Division a marked improvement is reported, and excellent results are anticipated from the cement formation in the neighborhood of Cross-over Creek and the Tangil River. From what I have heard I am inclined to think that, properly worked, there is a very large field for profitable operation; for though the cement is found only in 'patches,' its presence has been traced many miles, and I am informed that wherever tested it has been proved to be 'payable.' The locality being distant about ninety miles I have not yet been able to visit it, but I purpose doing so when opportunity offers."

Whether these drifts will be found to bear the same character within the large area occupied by tertiaries in the south-eastern part of Gippsland, is yet a matter of doubt.

On nearly all the goldfields the conglomerate is worked, and everywhere it is much of the same character. There are heaps of it on the older goldfields which will some day be put through the mills; and the large areas in the deeper ground at Castlemaine, Sandhurst, and Maryborough, will no doubt be explored for this alone. It is generally neglected and thrown aside at a new rush. The miners cannot wash it, and they cannot store it with any prospect of reaping advantage from it, because it is not until the goldfield is well explored that machinery for crushing it is available.

Some very rich samples have been forwarded to the Mining Department by Mr. James McIntyre, of Sandhurst, who procured them for the public collection from the new lead at Myer's Creek. The stuff is specked with gold.

* *Mining Surveyors' Reports*, March, 1861, p. 102, vol. III.

† *Mining Surveyors' Reports*, July, 1861, p. 279, vol. III.

‡ Mr. Brown, *Report* for October, 1860, p. 293, vol. II.

Nuggets found in the Alluvium.

The number of large nuggets which have been found in the colony, and respecting which information is contained in Mr. Birkmyre's list, is ninety-eight, and the aggregate weight is 36,218 ozs. 2 dwts. 22 grs., showing an average of 369 ozs. 11 dwts. 11 grs. Some of these weighed nearly 3,000 ozs., and some as little as 5 dwts. It must be surprising to those who have carefully considered the question that the number is so small, but it must be remembered that a great number of nuggets have been found which are not included in this statement, and respecting which nothing certain is known.

The formation of nuggets, strange to say, has been accounted for in various ways. Numerous theories have been invented to account for their origin. Some suppose that they have *grown* in the alluviums, getting larger day by day, and that they have increased by successive layers of gold being imposed on a solid nucleus! This may cause the reader to smile, but nothing affecting such subjects which is advanced by persons of intelligence is fairly a subject of ridicule. The fact that nuggets in general are almost free from impurities is, in the minds of some, an argument against their origin in common with small particles of gold in quartz veins; and, again, it is suggested that large pieces of gold are not *usually* found in veins.

Mineralogists state that the purity of alluvial gold is due to its having been exposed for long periods to the action of water and atmospheric air, whereby the silver, copper, iron, &c., which are alloyed with the gold in the veins, have been decomposed and removed. This explanation is so reasonable, having regard to the constituents of the minerals usually associated with gold in the alluviums, that it is almost startling to find any person bold enough to doubt the sufficiency of it.

Large pieces of gold have been found in quartz veins, and scarcely any large nugget has been unearthed which has not had a great quantity of quartz adhering to it or intermixed with it; and surely it is but reasonable to conclude that nuggets have been formed in the veins in the same manner, and probably at the same time, as other smaller pieces of gold. That we have not found as many large pieces of gold in the veins as in the alluviums is just what might have been expected. Every superficial foot of auriferous drift represents many thousand feet vertical of veins; and until we shall have explored the existing veins completely, and ground them down and worked them to a depth equal to that operated on by the denuding forces in past ages, we cannot say whether or not the proportion of nuggets found in the alluviums is in excess.

The *hundredweight of gold* discovered on Dr. Kerr's station, in New South Wales, was taken from a vein which cropped out on the surface. "The largest of the blocks was about a foot in diameter, and weighed 75 lbs. gross. Out of this piece 60 lbs. of

pure gold were taken. Before separation it was beautifully encased in quartz." The "Blanche Barkly" nugget contained 2 lbs. of quartz, clay, and oxyd of iron. The two large nuggets found at Dunolly, which weighed 2,952 ozs., presented gold distributed through a rust-colored matrix. The "Lady Hotham" nugget contained much quartz and sulphuret of iron. The large nugget found at Canadian Gully, Ballaarat, showed gold finely intersected with quartz. Every nugget, whether large or small, which has not presented indications of having been very much worn, has borne with it proofs that it had been broken out of a vein. The most careless examination of any large piece of gold would satisfy the observer that it had not been formed differently from smaller pieces; but whatever is uncommon is, in the minds of some, marvellous.*

In a quartz vein in the Garibaldi leased lands, at St. Arnaud, a mass of gold weighing 500 ozs. was found, and with it other smaller pieces, weighing in the aggregate nearly 400 ozs. Mr. Hall, of Avoca, obtained from one of the deep leads in the locality a large smooth boulder of quartz, containing a piece of gold which, detached from the quartz, would form a nugget of considerable size; but the gold is firmly embedded in the quartz, and has taken the rounded form so completely as to present, in fact, almost an even surface. It is probable that the mass, when detached from the reef, was caught in some hole in the rock, and was gradually shaped by attrition in that spot, and not moved violently in the bed of the stream, where it would have been broken and the gold set free.†

Much stress is laid on the fact that nuggets are sometimes found at a considerable distance from a quartz reef; but it has not probably been considered that the reef from whence the mass was derived may have been completely carried away, and that the origin of the gold may not have been in what is now the nearest reef. Floating masses of quartz—such as are found at Inglewood—may have contained many nuggets, and where the gold they contained was set free we should look in vain for the reef. We have also to consider the conditions under which a mass of gold might be moved to a great distance when embedded in a rock of low specific gravity.

These subjects are of high importance to the mineralogist, and scarcely of less moment to the practical miner, and it is only fair to give opportunity of considering them from every point of view.

Mr. George Ulrich—at once an accomplished mineralogist and a miner of much experience—thus writes in reference to the hypotheses advanced by men of science.

Speaking of nuggets, he says:—

"If we consider that these consist of the nearly specifically heaviest known matter concentrated into spaces, offering, comparatively speaking, the smallest surface of attack, it must appear evident that a tremendous, so to speak, cataclysmic force would be required to move such lumps; and yet most have been found, far removed from auriferous quartz reefs, which the lay or run of the respective gold leads in which they occur points out as the source of the gold; and some in positions—for instance,

* Some small portions of this paper were printed in a pamphlet written by me, and published seven years ago; and other parts in a pamphlet published two years ago—and, as many parts of both have been appropriated wholesale, without acknowledgement, by writers at home, it is necessary to caution the reader against coming to too rapid conclusions when he sees reproduced in this work, nearly word for word, what may be found in works printed quite lately. It would be hard to be charged with plagiarism when I am only using my own property.

† As regards this action see *Geological Observer*, Sir H. T. de la Beche, p. 40. Many remarkable granitic pebbles, as large as cannon balls, and formed in this manner, are preserved in the local museum at Beechworth.

in the sand overlying the gravel—which, considering their weight and the otherwise regular arrangement of the drift deposit from the surface downward, viz., clay, sand, and fine and coarse gravel, are quite inexplicable. If we add to this, that nuggets even above 1 oz. in weight are of rare occurrence in quartz reefs, a doubt must naturally arise, whether such ponderous masses, as we now find, have been actually derived from the reefs; and it becomes of interest to inquire whether, perhaps, other sources do not exist, to which they may owe their origin. Considering the rule of the gradually-decreasing size of the particles of gold in reefs, from the surface downward, it might no doubt with just reason be urged that, as the reefs have been extensively denuded (of which the formation of the drifts furnishes convincing proof), the same rule would inversely hold good for the denuded portions—i.e., the particles of gold were gradually increasing in size towards the original surface of the reefs; and as instances are known of nuggets several pounds in weight having been found in our present reefs, the denuded portions might have contained them both of larger size and more numerous. However, sound as this argument may be in certain respects, the general difference in standard of fineness between alluvial and reef gold bears strongly against it, and certain facts and results of experiments besides, lend aid to an hypothesis, some time ago advanced by Mr. Selwyn—namely, that nuggets may have been formed, and generally that particles of alluvial gold may gradually increase in size through the deposition of metallic gold (analogous to the electro-plating process), from the meteoric waters which circulate through the drifts, and which must have been, during the time of our extensive basaltic eruptions, of a thermal, and probably highly saline, character, favorable to their carrying gold in solution.

“The collateral questions to answer here are—firstly, is gold contained in the meteoric drift water? and, secondly, do agencies exist by which it can be deposited from that solution in a metallic state—i.e., as a solid coating on nuclei presented to it? Both questions are nearly satisfactorily solved, the first by the auriferous character of iron pyrites, occurring frequently in the leads of Ballarat, Clunes, Daylesford, &c., which shows the shapes of roots and branches of trees, forms parts of and occupies cavities in driftwood, &c., and is therefore of very recent origin; the second, by an accidental discovery made by Mr. Daintree some time ago, and also by some recent interesting experiments by Mr. Charles Wilkinson, of the Geological Survey. Mr. Daintree's discovery consisted in the fact that a speck of gold, lying in a solution of chloride of gold, increased to several times its original size after a small piece of cork had by accident fallen into the solution. This signifies, therefore, that organic matter, which is abundantly contained in the drifts, may be the agent by which gold is deposited from meteoric waters in the manner required for the solution of the problem. Mr. Wilkinson's experiments prove further, that besides gold itself, iron, copper, and arsenical pyrites, galena, zincblende, molybdenite, wolfram, &c., form likewise favourable nuclei, which, if immersed in a weak solution of chloride of gold, receive a solid coating of this metal by agency of organic matter (a small chip of wood or bark, for instance, swimming in the solution). In addition to these data, we have the curious coincidence with Mr. Selwyn's views, touching the character of the meteoric water in earlier times, that on our western goldfields only (Ballarat, Daisy Hill, &c.), where evidence of tremendous basaltic eruptions meets the eye on every side, all the large nuggets have hitherto been found; whilst in the eastern and northern goldfields (Gippsland, Yarra, Ovens, &c.), on which basaltic streams are either absent or of very limited extent, the gold is generally very fine and nuggets above an ounce in weight are of the greatest rarity.

"Far as these data tend towards strengthening Mr. Selwyn's hypothesis, there are, however, many doubtful points yet to be cleared up. It is, for instance, of the greatest interest to confirm, by careful quantitative analysis of large quantities of drift water, that gold exists in it; to determine in what amount; and, though scarcely practicable, yet of high importance, to find out in what combination. It is certainly most probable that, as our drift waters generally are saline, gold is in solution as a chloride, but should this not be found to be the case, it is necessary to examine whether the new salt (which might, judging from Professor Bischoff's experiments, perhaps be a silicate of gold) is also decomposable in the required way by organic matter, or other agencies, existing in the drifts. The most conclusive test for the confirmation of the hypothesis would no doubt be to ascertain, by cutting nuggets in halves, and careful appropriate analysis afterwards, that they contain nuclei of lower standard gold—the portions derived from the reefs—than the surrounding masses formed by deposition from meteoric waters." *

These arguments, advanced by gentlemen of much experience, are entitled to consideration, and I have purposely quoted at length from Mr. Ulrich's paper, in order that the matter may be fairly stated.

It may be suggested, however, that if nuggets have been formed in alluviums and tertiary strata, through the deposition of metallic gold from the meteoric waters which circulate through the drifts, during the relatively short periods which have elapsed since the formation of these strata, it is even more probable that the same meteoric waters percolating through and saturating the older sedimentary rocks and their intersecting quartz veins should have formed, during the lapse of countless ages, quite large masses of gold around nuclei in the many cavities of these rocks. This seems a just conclusion. It is hard to believe that the force which is active in modern times was passive in remote periods.†

* *Notes on the Physical Geography, Geology, and Mineralogy of Victoria*, by Alfred R. C. Selwyn and George Ulrich, page 43.

† I possess a pamphlet, in all respects a curiosity of literature and science, written by Mr. Evan Hopkins, who visited the goldfields of Victoria in 1852-3. It treats of the formation of nuggets. Not the least remarkable among the many very remarkable statements in his paper are the following:—"The auriferous clay and mica slates generally enclose nodules and veins of white and light red quartz. * * * * * These gold quartz veins are extremely deceptive to the uninitiated: being frequently found glittering with gold on the surface, with occasional large masses in cavities, and large flakes in the joints and fractions [*sic.*]; yet at a few fathoms in depth, in the compact quartz, they seldom produce sufficient gold to pay the cost of the mere blasting of the rock. Yet these quartz veins contain a small proportion of gold below, although invisible, which, when left to the natural processes of decomposition and internal metallic aggregation, produce rich superficial *débris*. A very interesting result in connection with this superficial action and the liberation and aggregation of the precious metals from the containing rocks, may be seen at the roots of great trees, when in immediate contact with quartzose bands—(*see* section 2). [*The drawing shows several large masses of gold at the roots of the trees undoubtedly.*] Huntsmen and herdsmen have been the discoverers of many of the silver mines in South America, especially in Chili and Peru, by detecting large masses of metallic silver attached to the roots of trees, and sometimes growing in a somewhat arborescent form amongst the scrub. The same kind of discoveries have been made in gold regions, not alone in South America, Veraguas, and California, but also in Victoria and New South Wales; large masses of gold have been found aggregated near the roots of large trees and strong grass, often in very singular forms, and evidently indicating the influence of the roots in the formation and the amount of gold drawn out of the rock below."—*On the Geology of the Gold-bearing rocks of the World and the Gold-fields of Victoria*, by Evan Hopkins, C.E., F.G.S., &c., 1853, p. 13. The work is evidently written seriously.

Perhaps more weight might be attached to the theory of the formation of nuggets, which Mr. Ulrich supports, if these masses of gold were found only in deep *leads*; but we find large nuggets protruding from the soil, buried only a few inches, and lying on the bed-rock in the most recent gravels—in places, in short, where they could not have been subjected to the action which is supposed to have resulted in the formation of large nuggets at Ballaarat.

In dealing with questions of this nature, scrupulous—almost painful—accuracy in the observations is indispensable; and it is necessary that the observations should be numerous as well as accurate. The many opportunities of examining and testing the character of the gold in the form of nuggets have been let slip in times past, but we may naturally hope that extraordinary care will be taken in future to collect and record the results of experiments.

The statement that all the large nuggets have hitherto been found on our western goldfields only (Ballaarat, Daisy Hill, &c.), where evidence of tremendous basaltic eruptions meet the eye on every side, has been written perhaps hastily.

On the northern goldfields, at Dunolly—far removed from the basaltic areas—two specimens weighing 2,952 ozs. were found in 1857; and this place, as well as Kingower and Korong (still further removed from any basaltic eruption), is quite famous for the great number and the immense size of the nuggets dug out of the alluviums.

At Kingower, which is distant more than twenty miles from any basaltic rocks, the *Blanche Barkly* nugget, weighing 1,743 ozs. 13 dwts., was found on the 27th August, 1857.

At McIntyre's Diggings, near Kingower, a nugget of 810 ozs. was discovered in March, 1867, and two other specimens, respectively 805 ozs. and 782 ozs., were taken from the surface soil near the same place.

At McIvor, not near any basaltic eruption, two nuggets of the following weights were found—658 ozs. and 645 ozs.

An examination of Mr. Birkmyre's list will show that the goldfields most remote from the basaltic areas have been the richest in large nuggets; and as regards Gippsland, if they are not large they are numerous.

In the same list will be found information relative to large pieces of gold which have been found in quartz veins, and as regards these it is well to remark that they do not always consist of lower standard gold.*

Mr. George Foord, who it is admitted is our highest authority on all questions relating to the chemistry of gold, thus writes:—

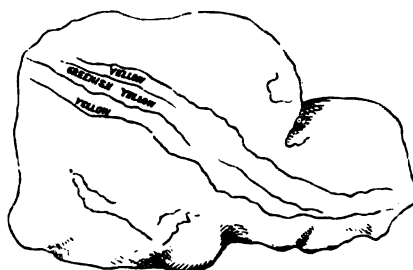
"1. I have repeatedly taken samples from different parts of large nuggets, with the view of ascertaining the uniformity or otherwise of their composition. Although working with very great care, I have never been able to find a difference in fineness greater than that attributable to working error, say one or two parts in 10,000. On the other hand, I have seen one specimen in which the gold appeared of different colors in different parts. It was a water-worn quartz pebble, penetrated by a vein of gold, and the inner band or centre of the vein appeared of a lower quality to that of the outer portions. The inner part a greenish yellow,

* See *Assays*, by Mr. George Foord, F.C.S., page 75.

the outer parts a full yellow ; implying more silver alloy in the inner band ; somewhat thus :—

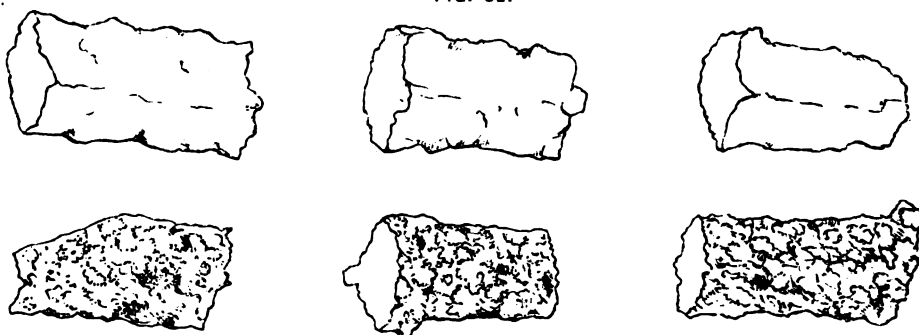
Mr. Shackell, of Beechworth, took it to England with him, at least I believe so. Remember that this (Fig. 81) is only a diagram, and not an actual sketch made from the stone. I have seen also a sample of quartz from Crowlands, the different specks of gold in which were of obviously different fineness. This was even recognized by the person who brought it, and easily seen in the markings on the touchstone. The quartz in question contained crystals of pyromorphite.

FIG. 81.



"2. A good deal has been said and written concerning the formation of nuggets by the coalescence of grains of gold in the alluvial state, a process somewhat similar to that by which large snowballs are constructed. No one can say that this has never taken place ; but if I were asked my opinion it would lean very little to the acceptance of this view. The physiognomy of nuggets points almost invariably to their position in the lode. Their perfect or almost perfect uniformity of composition points also distinctly to the same origin. So does the attached matrix. To give an example, I would instance a series of three large nuggets which were, I believe, consecutively found at Tarrangower (bought by Wm. Clarke and Sons from the Colonial Bank of Australasia ; photographs of them are extant). These had one very rough side and one comparatively smooth side ; and although found separately, the general characters were preserved throughout the three, so as to leave little doubt of their being elements of one series, so to speak, and derived from a vein in the rock, the two different kinds of surfaces being counterparts of the rock surfaces on which the gold had been originally deposited, somewhat thus :—

FIG. 82.



Remember that these are only from memory, and that they are intended to show only the general facts as bearing on the question of the origin of nuggets.

"3. As to the deposition of the gold in the quartz, I might, with due deference to other opinions, mention my own. We hear a good deal about fusion and sublimation, and so on. All is certainly no more than speculation at present, and there is no reason against a patient attention for any views of the kind. It is quite easy to conceive the filling of veins with molten gold, and St. Claire Deville has shown that gold can be volatilized even by artificial means. But, on the other hand, there are

circumstances which are highly favorable to the view which supposes the deposition of gold 'in the wet way,' by precipitation in fact. The manner of its distribution in the quartz, and particularly its association with such minerals as galena and the various kinds of pyrites, are among other reasons for supposing an origin by the wet way. So are cases like that of Mr. Shackell's stone. Compare this with the reasoning concerning the deposition of the Lake Superior copper and silver in Wilson's *Prehistoric Man*. What a little we know! and what a little has been done experimentally.

"4. If we could only substantially demonstrate the existence of compounds of gold in oceanic water, a natural hypothesis of gold deposition could soon be made out.

"5. I have never met with *pure* gold in nature; and I have never met with native gold free from silver. The native gold may be considered as silver alloys, and in fact they form a series from *nearly* pure gold to *nearly* pure silver. I should very much like to know whether any absolutely *gold-free* silver has ever been found, and proved to be such by a *critical examination*. If there really are native silvers which are quite gold-free, it would be interesting to establish the distinction, and the attendant conditions; if there is no such thing as native silver *gold-free*, the establishment of that fact would be no less important."

The tables which follow give much useful information as to the character of Victorian nuggets, and as to the conditions under which they were found.

The first, compiled by Mr. Birkmyre, an assayer of many years' experience, is of great value, containing as it does an account of many foreign nuggets, as well as particulars of nuggets found in Victoria; and the second, compiled by Mr. F. Knox Orme, the warden at Dunolly, contains all the facts which can be collected relative to the nuggets discovered on the goldfields under his charge.

This attempt to give some account of the modes of occurrence of the larger masses of gold is but a beginning, and there is a reasonable hope that in a little time it will be made more complete.

A TABULAR RECORD, SHOWING GENERALLY THE DATE OF DISCOVERY, IN VICTORIA AND OTHER COUNTRIES, OF THE MOST REMARKABLE SPECIMENS OF NATIVE GOLD; THEIR WEIGHT, AND, WHERE PRACTICABLE, THEIR SPECIFIC GRAVITY, ASSAY, AND WEIGHT OF PURE GOLD.—By WILLIAM BIRKMYRE, Esq.

Where the Asterisk (*) occurs, it denotes that the Nuggets or Specimens have been assayed by Mr. Birkmyre.

	Date of Discovery.	Gross Weight (Troy).	
		lb. oz. dwt. gr.	oz. dwt. gr.
1. "The Welcome Nugget," found by a party of twenty-four at Bakery Hill, Ballaarat, Victoria, at a depth of 180 feet; apparently water-worn, and of no regular shape, its length being twenty inches, breadth twelve, depth seven; containing about 10 lbs. of quartz, clay, and oxyd of iron. Previous to finding this great nugget the same party met with some smaller ones weighing from 12 to 45 ozs. It was first sold in Ballaarat, in 1858, for £10,500. After being exhibited for many weeks in Melbourne it was sold there, on the 18th March, 1859; it then weighed 2,195 ozs., and fetched £9,325, or £4 4s. 11d. per oz. Melted in London, November, 1859. Assay, 99.20 per cent. gold = 23 car. 3½ car. grs. (*)	15th June, 1858	184 9 16 0 or, in avoirdupois weight, 1 c. 1 q. 12 lb.	2,217 16 0

	Date of Discovery.	Gross Weight (Troy).			
		lb.	oz.	dwt.	gr.
2. "The Blanche Barkly," found by a party of four, quite by itself, at Kingower, Victoria, at a depth of thirteen feet, and within five or six feet of holes dug three years before. It measured twenty-eight inches in length, and ten inches in its widest part, and apparently contained 2 lbs. quartz, clay, and oxyd of iron. Melted in London, 4th August, 1858. Value, £6,905 12s. 9d. This nugget, previous to melting, was exhibited in Melbourne, and at the Crystal Palace, Sydenham, London, where it was an object of great interest, from its bulk, brightness, and solidity, the returns to the fortunate owners for some time being £50 per week. Assay, 95.58 per cent. gold=22 car. 3½ car. grs. (*)	27th Aug., 1857	145	3	13	0
3. Found at Canadian Gully, Ballaarat, Victoria, by a party of four, at a depth of sixty feet, and immediately after, a smaller one, weighing 76 ozs. Two of the party had been not longer in the colony than three months, when they returned to England with their prize in the steamer <i>Sarah Sands</i> . This specimen, although large, was not very attractive, for both, the gold and the quartz were dark colored. Melted in London in 1853. Weight before melting, 1,615 ozs. 10 dwts.; after, 1,319 ozs. 1 dwt. 12 grs. of fine gold, of 98.96 per cent. of pure gold, equal to 1,423 ozs. standard gold; value at £3 17s. 9d. per oz., £5,532 7s. 4d., the loss in weight in melting being 296 ozs. 8½ dwts. = 18.6 per cent.	31st Jan., 1853	134	11	0	0
4. Found by a native boy amongst a heap of quartz, on the surface of the ground at Meroo Creek, River Turon, fifty-three miles from Bathurst, N.S.W. It was in three pieces when discovered, though generally considered as one mass. The aboriginal who discovered these blocks observed "a speck of some glittering substance upon the surface of a block of the quartz, upon which he applied his tomahawk and broke off a portion." One of the pieces weighed 70 lbs. avoirdupois, and gave 60 lbs. troy of gold; the gross weight of the other two about 60 lbs. each. These three pieces, weighing 1½ cwt., contained 106 lbs. troy of gold, and about 1 cwt. of quartz. In the same year another nugget, No. 39, weighing 30 lbs. 6 ozs., was discovered in clay, twenty-four yards from the large pieces; and in the following year, also near to No. 4, there were found two nuggets, weighing 157 ozs. and 71 ozs.	July, 1851	106	0	0	0
5 and 6. Found at Dunolly, Victoria, two specimens, with gold distributed through a rust-colored matrix. Melted in Melbourne, October, 1857, the produce being 1,363 ozs. 18 dwts. of gold. Value about £5,500.	1857	237	0	0	0

	Date of Discovery.	Gross Weight (Troy).			
		lb.	oz.	dwt.	gr.
7. Found by a party of four, at Burrandong, near Orange, N.S.W., at a depth of thirty-five feet; when pounded with a hammer, it yielded 120 lbs. of gold, for which £5,000 were offered. Melted at the Sydney Mint, when it weighed 1,286 ozs. 8 dwts.; after melting, 1,182 ozs. 7 dwts.; loss, 8 per cent.; fineness, 87.4 per cent., the standard weight of gold being 1,127 ozs. 6 dwts. Value, £4,389 8s. 10d. The gold was mixed with quartz and sulphuret of iron (mundic). Assay, 87.40 per cent. gold = 20 car. $3\frac{1}{4}$ car. grs.	1st Nov., 1858	107	2	8	0
8. "The Lady Hotham Nugget," found near Canadian Gully, Ballarat, Victoria, at a depth of 135 feet. It contains much quartz and sulphuret of iron, but is a fine specimen. From the same hole, there were obtained upwards of 220 lbs. in smaller nuggets. The value of gold, therefore, from this claim was not less than £13,000. The specific gravity of this specimen was 6.093, and the estimated weight of pure gold 755 ozs. (*)	8th Sept., 1854	98	1	17	0
9. Found at Miask, Ural Mountains, Russia, at a depth of nine feet; weight, 87 lbs., 92 zolotniks Russian (Tegoborski), 36.025 kilogrammes (Humboldt). In bulk it is almost exactly half of an imperial gallon = 138 cubic inches. Its supposed value, at 22 carats (British Standard), containing 8.33 per cent. alloy, is £4,508 19s. 3d. Preserved in the Museum of Mining Engineers, St. Petersburg.	Tegoborski 7th Nov., 1842	96	6	2	0
10. Found at Canadian Gully, Ballarat, Victoria, by a party of three, who also obtained No. 12 in the same claim, in a drive at a depth of sixty feet, amongst quartz boulders and washing-stuff, containing an ounce to the tub—its length, twenty inches by eight and a half, and five inches thick. The first blow of the pick led the miner to suspect it had struck gold; with the second, the pick stuck in the mass. The gold is finely intersected with quartz. Estimated value of both No. 10 and 12—£7,500	20th Jan., 1853	93	1	11	0
11. Found at Blackman's Lead, Maryborough, Victoria, at a depth of five feet. Sold in Melbourne, in 1855, for £3,250. Melted by me in the same year. The specific gravity of this specimen was 8.58, and the estimated weight of pure gold 833 ozs. 14 dwts. (*)	June, 1855	86	2	5	0
12. Found at Canadian Gully, Ballarat, Victoria. This mass was found two days after the discovery of No. 10, in the same claim and tunnel, and within ten feet of No. 3—length, twelve inches by six in breadth, and six and a-half inches thick, being somewhat in the shape of a pyramid. This is a very fine specimen, consisting of much gold, with remarkably white quartz. The two working	22nd Jan., 1853	84	3	15	0

	Date of Discovery.	Gross Weight (Troy).	
		lb. oz. dwt. gr.	oz. dwt. gr.
diggers continued at work nearly a fortnight, when they obtained about 100 ozs. of small gold—they now sold their claim for eighty guineas			
13. "The Heron Nugget," found by two young men near Old Golden Point, Fryer's Creek, Mount Alexander, Victoria. A solid lump of gold. They were offered in the district £4,000, but refused—(sold in England for £4,080). Besides this mass, they were likewise fortunate in gold-seeking, although only three months in the colony. In the same locality, about three years before, nuggets of 7 lbs. and 22 lbs. were obtained	29th March, 1855	84 0 0 0	1,008 0 0
14. Found at Ballarat, Victoria, at a depth of 400 feet; a solid lump of gold, and with it 100 ozs. of smaller gold.	Aug., 1860	69 6 0 0	834 0 0
15. Found at McIntyre Diggings, near Kingower, Victoria	March, 1857	67 6 0 0	810 0 0
16. Found by two men at Kingower, Victoria, within a foot of the surface; eighteen and a-half inches long, five and a-half broad, and an average thickness of two inches	1860	67 1 0 0	805 0 0
17. Found at Kingower, Victoria	Feb., 1861	65 2 0 0	782 0 0
18. Found at Daisy Hill, Victoria, at three and a-half feet from the surface. The specific gravity of this specimen was 7.147, and the estimated weight of pure gold 521 ozs. 4 dwts. (*)	22nd Oct., 1855	59 7 0 0	715 0 0
19. Found near the City of La Paz, situated 12,170 feet above the sea-level, on the eastern slope of the Andes in Bolivia, Upper Peru. This nugget weighed 90 Spanish marcs of 3,550½ troy grains per marc=665 troy ozs. It varied in composition from 75 to 95.8 per cent. gold	Raynal, 1730	55 5 0 0	665 0 0
20. Found at McIvor, Victoria, at a depth of sixteen feet	Oct., 1858	54 10 0 0	658 0 0
21. Found at Back Creek, Taradale, Victoria, by a party of three, at a depth of twelve feet; a solid lump of gold, and at the same time about 80 ozs. in small nuggets. The value of the claim at this depth was nearly £3,000	May, 1856	54 0 0 0	648 0 0
22. Found at McIvor, Victoria. Previous to melting, £2,500 were offered for this nugget. It was melted in the Oriental Bank, and lost eleven and a-half per cent.=74 ozs. 2 dwts.	12th Oct., 1855	53 9 0 0	645 0 0
23. Found in an old hole at Eureka, Ballarat, Victoria. Smooth and nearly free of quartz. Dimensions, nine inches long by seven broad	7th Feb., 1854	52 1 0 0	625 0 0
24. Found at Yandoit, Castlemaine, Victoria. Weight, after cleansing, 581 ozs. 17 dwts., still containing 6 ozs. of quartz; estimated value, £2,180. Length, sixteen inches; breadth, ten and a-half; thickness, varying three-quarters to two inches. In the same locality, and within six weeks, five more nuggets were found	April, 1860	50 0 0 0	600 0 0

	Date of Discovery.	Gross Weight (Troy).			
		lb.	oz.	dwt.	gr.
25. Found at White Horse Gully, Bendigo, Victoria, in the same hollow with No. 40 and No. 41. It was partly encrusted with quartz, valued at £2,100	Oct., 1852	47	9	0	0
26. Found at Bakery Hill, Ballaarat, Victoria, at a depth of 185 feet. This nugget and No. 1 were found within 150 yards of each other	6th March, 1855	47	7	0	0
27. The "Nil Desperandum Nugget," found at a rush near the Native Youth, Ballaarat, Victoria, at a depth of nine feet, with other lumps weighing from 1 oz. to 9 ozs. This mass was nearly solid gold; sold in Melbourne, 4th April, 1859—it then weighed 505 ozs. Assay, 98·80 per cent. gold = 23 carats 2½ carat grains; fetched £1,950, or £3 17s. 2½d. per oz.	Nov., 1857	45	0	0	0
28. Found at Blackman's Lead, Maryborough, Victoria, at a depth of six feet	15th Jan., 1858	44	9	5	0
29. Found by an Indian woman almost on the surface of the alluvium of the River Haina, near to the City of San Domingo, Hayti. This specimen contained some stone (supposed in those days not yet converted into gold), and was said to weigh 3,600 castellanos, which, at 71 troy grains per castellano, is equal to 532½ ozs. troy. It was shipped to the King of Spain, as a token of the wealth of Columbus's great discovery, but lost during a storm, with 200,000 castellanos = 29,583 ozs. troy of gold	1502	44	4	10	0
30. Found in Victoria, by two men, at a depth of eighteen feet. The specific gravity of this specimen was 5·99, and the estimated weight of pure gold 335 ozs. 10 dwts. (*)	1856	43	8	0	0
31. Found at Bakery Hill, Ballaarat, Victoria, a solid lump of gold, in next claim to No. 26 (*)	Mar., 1855	40	0	0	0
32. Found in Reed's Mine, Cabarras County, North Carolina, United States. It weighed 28 lbs. avoirdupois, and was eight and a-half inches long, five broad, and one thick; dug up by a negro from within a few inches of the surface	1821	34	6	16	0
33. Found at the Twisted Gum-tree, Ballaarat, Victoria	—	34	0	0	0
34. Found at Kiandra, Snowy River, N.S.W. - -	Oct., 1860	33	4	0	0
35. Found at Yandoit, Castlemaine, Victoria, at a depth of sixteen feet	1860	32	0	0	0
36. Found at Robinson Crusoe Gully, Bendigo, Victoria, in an old pillar of earth of a deserted claim. Length, twelve inches; width, six inches; thickness, from half an inch to two inches	Mar., 1861	31	5	6	0
37. Found in Canadian Gully, Ballaarat, Victoria. It contained a good deal of quartz. Sold in Melbourne, March, 1853, for £1,465 16s. 11d. = £3 19s. per oz.	1853	30	11	2	0

	Date of Discovery.	Gross Weight (Troy).			
		lb.	oz.	dwt.	gr.
38. Found by two diggers in Canadian Gully, Ballarat, Victoria, at a depth of sixty feet; at the same time another nugget (No. 86), weighing 143 ozs. 15 dwts., and both about thirty feet from No. 3	Feb., 1853	30	8	0	0
39. "The Brenan Nugget," found at Meroo Creek, Turon River, N.S.W., embedded in clay; measures twenty-one inches in circumference. It was found twenty-four yards from No. 4. Sold in Sydney, 1851, for £1,156	1851	30	6	0	0
40. Found by a negro, in the Province of Choco, New Granada, South America. His master presented it to the cabinet of the King of Spain	Humboldt, 1793	30	4	11	0
41. "The Victorian Nugget," found in the White Horse Gully, Bendigo, Victoria, close to No. 43. Bought for presentation to the Queen by the Colonial Legislature, who paid £1,650 = £4 17s. per oz. Its surface was partly encrusted with quartz and oxide of iron	20th Sept., 1852	28	4	0	0
42. Found at Bendigo, Victoria. The specific gravity of this specimen was 13.09, and the estimated weight of pure gold 314 ozs. (*)	1854	28	2	17	0
43. "The Dascombe Nugget," found at Bendigo, Victoria. Bright, and free from quartz. It was found close to No. 41, amongst gravel, about a foot from the surface. Sold in London 5th November, 1852 (it then weighed 330 ozs. 15 dwts.), for £1,500, or £4 10s. 8d. per oz.	Jan., 1852	27	8	0	0
44. Found at McIvor, Victoria, with smaller gold weighing 35½ ozs., of which, nuggets weighing respectively 11½ ozs., 11 ozs., 6½ ozs., and the washdirt remaining would yield 1 oz. gold to the load	1857	27	4	0	0
45. Found at McCallum's Creek, Victoria - - -	—	27	2	10	0
46. Found at Miask, Ural Mountains, Russia, near to the surface. Weight, 10.117 kilogrammes (15,432.3 grains troy = 1 kilogramme, Prof. Miller, <i>Phil. Trans.</i> , 1856)	Humboldt, 1826	27	1	5	0
47. Found in the Mines of Eastern Siberia. Weight 24 lbs. Russian (6,320 grains troy = 1 lb. Russian)	Tegoborski	26	4	0	0
48. Found at Baycito, California, at a depth of fifty-four feet. This was the largest nugget as yet known in California	24th April, 1852	25	5	0	0
49. Found at the McIntyre Diggings, Victoria, at a depth of six feet	Sept., 1858	25	0	0	0
50. Found at Kingower, Victoria, by two men, in shallow sinking	Aug., 1861	25	0	0	0
51. Found at Bendigo, Victoria - - - - -	1852	24	0	0	0
52. Found at Kingower, Victoria. The specific gravity of this specimen was 5.25, and the estimated weight of pure gold 162 grs. 16 dwts. (*)	1854	23	6	2	0
53. Found at Evans' Gully, Kingower, Victoria - -	April, 1861	23	5	17	0

	Date of Discovery.	Gross Weight (Troy).	
		lb. oz. dwt. gr.	oz. dwt. gr.
54. Found in Victoria ; produced when melted 161 ozs. 14 dwts. of gold, containing 97·4 per cent. pure gold. The specific gravity of this specimen was 5·3, and the estimated weight of pure gold 159 ozs. 12 dwts. 19 grs. Assay, 97·4 per cent. gold = 23 carats 1½ carat grs.	1855	23 5 0 0	281 0 0
55. Found at Jones's Creek, Victoria - - - -	1856	23 5 0 0	281 0 0
56. Found at Daisy Hill, Victoria. Sold for £1,019= 74s. 1d. per oz. The specific gravity of this specimen was 14·05, and the estimated weight of pure gold 259 ozs. 12 dwts. 12 grs.(*)	1856	22 1 0 0	275 3 18
57. Found at Golden Point, Fryer's Creek, Victoria -	—	22 0 0 0	264 0 0
58. Found at Brown's Diggings, Victoria ; a fine nugget ; sold for £1,022 4s. 6d., or £3 17s. 7d. per oz.	23rd Oct., 1856	21 11 8 0	263 8 0
59. Found at Kingower, Victoria, within four feet of the surface	May, 1856	21 8 0 0	260 0 0
60. Found at Mount Korong, Victoria, at one foot and a-half below the surface ; valued at £1,000	May, 1856	21 3 13 0	255 13 0
61. Found at Gongo Soco, Minas Geraes, Brazil ; gold and quartz ; raised from the mine of the late Imperial Brazilian Gold Mining Association	1832	20 2 0 0	242 0 0
62. Found at Mount Blackwood, Victoria, on the surface of the ground ; composed of gold, quartz, and oxyd of iron. The specific gravity of this specimen was 6·57, and the estimated weight of pure gold 167 ozs. 18 dwts.(*)	1855	20 0 18 0	240 18 0
63. Found at Yandoit, Castlemaine, Victoria, within twenty feet of the surface ; a solid lump of gold	1860	20 0 0 0	240 0 0
64. Found in the Ural Mountains, Russia - - -	—	20 0 0 0	240 0 0
65. Found at White Hills, Maryborough, Victoria, at a depth of twelve feet ; a solid lump of gold	1856	19 8 0 0	236 0 0
66. Found at Kingower, Victoria, within half an inch of the surface	Feb., 1861	19 8 0 0	236 0 0
67. Found at Cabarras County, North Carolina, United States	Whitney	19 5 6 0	233 6 0
68. Found at Kingower, Victoria, on the surface of the ground, by a prospecting party ; it was covered with green moss ; when freed of quartz and moss weighed 188 ozs. 15 dwts.	May, 1860	19 2 0 0	230 0 0
69. Found at Carson's Creek, Stanislaus River, California ; the property of the Bank of England	Aug., 1850	18 3 0 0	219 0 0
70. Found at New Chum Hill, Klandra, Snowy River, N.S.W.	July, 1861	16 8 0 0	200 0 0
71. Found in the Ural Mountains, Russia - - -	—	16 2 0 0	194 0 0
72. Found at Mount Korong, Victoria - - -	Aug., 1859	16 0 0 0	192 0 0
73. Found on the surface of the ground at Bryant's Ranges, twelve miles from Castlemaine, Victoria ; white quartz and gold. The specific gravity of this specimen was 4·41, and the estimated weight of pure gold 87 ozs. Assay, 95·50 per cent. gold = 22 carats 3½ car. grs.(*)	1854	15 3 8 12	183 8 12
74. Found at Tarrangower, Victoria - - -	May, 1855	15 0 0 0	180 0 0

	Date of Discovery.	Gross Weight (Troy).			
		lb.	oz.	dwt.	gr.
75. Found at Maryborough, Victoria; gold, quartz, and oxyd of iron. The specific gravity of this specimen was 5.25, and the estimated weight of pure gold 103 ozs. 14 dwts. (*)	1854	14	10	16	0
76. Found in California; received at the United States Mint, 1849	—	14	6	0	0
77. Found in the Ural Mountains, Russia - - -	—	14	3	0	0
78. Found in Victoria. On the surface of this nugget there was only a slight indication of gold, and until the specific gravity was taken almost valueless. Indeed, this was one of the most remarkable specimens ever tested. After taking the specific gravity, it was purchased to the mutual satisfaction of both parties; it was then broken up, when a solid lump of gold of an oval form was found in the centre. The specific gravity of this specimen was 3.1, and the estimated weight of pure gold 29 ozs. (*)	1853	13	10	10	0
79. Found in Calaveras Co., California, at fifteen feet from the surface. Estimated to contain eighty per cent. solid gold, at 17 dols. per oz. = 2,128 dols. or £459	—	13	4	10	0
80. Found at Kiandra, Snowy River, N.S.W. - -	Mar., 1860	13	4	0	0
81. Found at Mercoo Creek, Turon River, N.S.W., near to No. 4	1852	13	1	0	0
82. Found at Evans' Gully, Kingower, Victoria -	1861	12	9	10	0
83. Found in Anson County, North Carolina, United States	Whitney, 1829	12	1	16	0
84. Found at Jones's Creek, Mount Moliagul, Victoria (*)	1855	12	1	5	0
85. Found by Chinamen, at Creswick Creek, Victoria. The specific gravity of this specimen was 6.74, and the estimated weight of pure gold 102 ozs.	May, 1860	12	0	0	0
86. Found in Canadian Gully, Ballaarat, Victoria, at a depth of sixty feet, at the same time with another, No. 38. Sold in Melbourne, March 4th, 1853 (when it weighed 142 ozs. 15 dwts.), for £567 8s. 6d. = £3 19s. 6d. per oz.	Feb., 1853	11	11	15	0
87. Found at Jones's Creek, Mount Moliagul, Victoria, at a depth of 20 feet. After pounding, to extract some quartz, it weighed 126 ozs.	—	11	8	0	0
88. Found at the Tooloom Diggings, N.S.W., nearly solid gold	1860	11	8	0	0
89. Found at Jim Crow, Victoria, at a depth of four feet	Sept., 1858	11	4	0	0
90. Found at Mount Korong, Victoria, 4½ feet from the surface. The specific gravity of this specimen was 5.62, and the estimated weight of pure gold 90 ozs. 14 dwts. (*)	Oct., 1856	11	0	9	0
91. Found in Victoria. The specific gravity of this specimen was 11.14, and the estimated weight of pure gold 103 ozs. (*)	1854	10	8	2	12

	Date of Discovery.	Gross Weight (Troy).			
		lb.	oz.	dwt.	gr.
92. Found at Yecorata, Sinaloa, Mexico. It weighed 16 marcs 4 ozs. 4 ochavas; fineness, 22 carats. Deposited in the Royal Cabinet at Madrid	Robertson, about 1771	10	2	10	5
93. Found at Kingower, Victoria, by a boy, a few inches beneath the surface	Sept., 1858	10	0	0	0
94. Broken off quartz rock in a mine at Tarrangower, Victoria; quartz specimen. The specific gravity of this specimen was 4.94, and the estimated weight of pure gold 64 ozs. 7 dwts. 2 grs. (*)	1861	9	11	14	18
95. Found in California. Received at the United States Mint, 1849	—	9	7	12	0
96. Found at Dunolly, Victoria; gold, quartz, and oxyd of iron. The specific gravity of this specimen was 12.05, and the estimated weight of pure gold 100 ozs. 2 dwts. 14 grs. (*)	1854	9	2	9	0
97. Found at Kingower, Victoria	Sept., 1861	8	10	15	0
98. Found at Mount Moliagul, by Chinamen; a solid lump of gold, value £400	Nov., 1857	8	8	8	0
99. Found at Kingower, Victoria	Sept., 1861	8	4	10	0
100. Broken off quartz rock in a mine at Tarrangower, Victoria. The specific gravity of this specimen was 4.00, and the estimated weight of pure gold 28 ozs. 6 dwts. (*)	1861	8	3	10	17
101. Found at Sonora, Mexico. Weight, 3 kilogrammes	Humboldt	8	0	9	0
102. Found at Jim Crow, Victoria. The specific gravity of this specimen was 4.88, and the estimated weight of pure gold 50 ozs. 12 dwts. (*)	1855	7	11	6	0
103. Found at Kiandra, Snowy River, N.S.W.	March, 1860	7	9	18	0
104. Found at Black Hill, Ballaarat, Victoria; a solid mass of gold.	14th Oct., 1851	7	6	0	0
105. Found at Louisa Creek, N.S.W.; gold and quartz	25th Oct., 1851	7	6	0	0
106. Found at Louisa Creek, N.S.W.; a solid lump of gold	—	6	10	0	0
107. Found at Mount Blackwood, Victoria. The specific gravity of this specimen was 5.84, and the estimated weight of pure gold 50 ozs. 9 dwts. (*)	1851	6	6	19	6
108. Found in Canadian Gully, Ballaarat, Victoria, in the same hole with No. 3	31st Jan., 1853	6	4	0	0
109. Found in Victoria. The specific gravity of this specimen was 7.3, and the estimated weight of pure gold 48 ozs. 4 dwts. (*)	1854	5	5	3	0
110. Found by two boys at Gundagai (new diggings), N.S.W.	July, 1861	5	4	7	0
111. Found in Victoria. The specific gravity of this specimen was 5.18, and the estimated weight of pure gold 34 ozs. 17 dwts. (*)	1855	5	1	18	0
112. Found in Victoria. The specific gravity of this specimen was 5.05, and the estimated weight of pure gold 33 ozs. 12 dwts. (*)	1854	5	0	9	0
113. Found in Victoria. Sold in Melbourne, 7th Jan. 1852, for 72s. 9d. per oz., the price of gold-dust, at the same time and place, being 59s. an ounce	1851	4	10	18	0

	Date of Discovery.	Gross Weight (Troy).	
		lb. oz. dwt. gr.	oz. dwt. gr.
114. Found at Store Creek, a tributary of the Nicholson River, Gippsland, Victoria, being the largest lump yet found in Gippsland	Jan., 1861	4 10 0 0	58 0 0
115. Found in Victoria. The specific gravity of this specimen was 6.56, and the estimated weight of pure gold 40 ozs. 2 dwts. (*)	1855	4 9 15 0	57 15 0
116. Found in Victoria. The specific gravity of this specimen was 12.06, and the estimated weight of pure gold 47 ozs. 1 dwt. (*)	1854	4 3 17 12	51 17 12
117. Found at Louisa Creek, N.S.W., gold and crystal-line quartz	1857	4 2 0 0	50 0 0
118. Found in Victoria. The specific gravity of this specimen was 4.829, and the estimated weight of pure gold 26 ozs. 2 dwts. (*)	1854	4 1 14 12	49 14 12
119. Detached from the parent rock, Tarrangower, Victoria; quartz specimen. The specific gravity of this specimen was 5.01, and the estimated weight of pure gold 26 ozs. 15 dwts. (*)	1861	4 1 0 19	49 0 19
120. Found in Victoria. The specific gravity of this specimen was 4.55, and the estimated weight of pure gold 23 ozs. 8 dwts. (*)	1855	3 11 17 0	47 17 0
121. Broken from the quartz of a mine at Tarrangower, Victoria; quartz specimen. The specific gravity of this specimen was 3.53, and the estimated weight of pure gold 13 ozs. 2 dwts. (*)	1860	3 8 4 6	44 4 6
122. Found at Mount Blackwood, Victoria. The specific gravity of this specimen was 9.43, and the estimated weight of pure gold 36 ozs. 5 dwts. (*)	1855	3 6 11 0	42 11 0
123. Found at New Chum Hill, Kiandra, N.S.W.	July, 1861	3 6 0 0	42 0 0
124. Found in Victoria. The specific gravity of this specimen was 4.52, and the estimated weight of pure gold 19 ozs. 4 dwts. (*)	1854	3 3 17 0	39 17 0
125. Broken off quartz rock in a mine at Tarrangower, Victoria; quartz specimen. The specific gravity of this specimen was 4.11, and the estimated weight of pure gold 11 ozs. 4 dwts. (*)	1860	2 4 15 12	28 15 12
126. Found at Leadhills, Lanarkshire, Scotland	About 1502	2 3 0 0	27 0 0
127. Found at Croghan Kinshela, County Wicklow, Ireland. It contained about 92.3 per cent. gold, 6.27 silver, and 0.78 iron	1797	1 10 0 0	22 0 0
128. Found at Merri-jig Creek, Gippsland, Victoria	—	1 6 6 0	18 6 0
129. Broken from quartz rock at Tarrangower, Victoria; quartz specimen. The specific gravity of this specimen was 6.37, and the estimated weight of pure gold 12 ozs. 3 dwts. 16 gra. (*)	1861	1 6 0 6	18 0 6
130. Found at Croghan Kinshela, County Wicklow, Ireland	1797	1 6 0 0	18 0 0
131. Found at Summer Hill Creek, N.S.W. The earliest nugget found in N.S.W. after the gold discovery there by Hargreaves	13th May 1851	1 1 0 0	13 0 0
132. Found at Mount Blackwood, Victoria. The specific gravity of this specimen was 5.69, and the estimated weight of pure gold 6 ozs. 18 dwts. (*)	1855	0 11 3 11	11 3 11

	Date of Discovery.	Gross Weight (Troy).	
		lb. oz. dwt. gr.	oz. dwt. gr.
133. Detached from quartz rock at Tarrangower, Victoria; quartz specimen. The specific gravity of this specimen was 10.10, and the estimated weight of pure gold 7 ozs. 19 dwts. 21 gra. (*)	1861	0 9 7 0	9 7 0
134. Found at Weisskirch, Austria	1851	0 9 0 0	9 0 0
135. Found at Rocky River, Nelson, New Zealand, quite free from quartz	1858	0 8 14 0	8 14 0
136. Found at Newfane, Vermont, United States; gold with rock crystal. The specific gravity of this specimen was 16.5	1826	0 8 10 0	8 10 0
137. Found in New Zealand; gold and dark-colored quartz	1853	0 8 0 0	8 0 0
138. Found at Canoona, Port Curtis, Queensland	1859	0 7 0 0	7 0 0
139. Found at Touffe des Pins, Canada	—	0 4 0 0	4 0 0
140. Found at Echunga, South Australia	Oct., 1852	0 2 14 0	2 14 0
141. Found in Breadalbane, Perthshire, Scotland	—	0 2 0 0	2 0 0
142. Found at Leadhills, Lanarkshire, Scotland; in the Cabinet of the late Lord Hopetoun	—	0 1 10 0	1 10 0
143. Found at Echunga, South Australia, seven feet below the surface	1852	0 1 10 0	1 10 0
144. Found at Avoca, Victoria, encrusted with black oxyd of manganese (*)	1856	0 0 17 0	0 17 0
145. Found in the parish of Creed, Cornwall, England	Borlase, 1756	0 0 15 3	0 15 3
146. Found at Tangier (new diggings), Nova Scotia...	1861	0 0 15 0	0 15 0
147. Found in Fingal, Tasmania	—	0 0 12 0	0 12 0
148. Found at Ballarat, Victoria; much water-worn. The specific gravity of this specimen was 18.71. Assay, 99.18 per cent. gold=23 carats 3½ carat grains (*)	—	0 0 10 19	0 10 19
149. Found in Kildonan, Sutherlandshire, Scotland ...	—	0 0 10 0	0 10 0
150. Found at Kingower, Victoria; it contained 61.9 per cent. gold, and 0.25 silver—the remainder composed of carbonate of bismuth and oxyd of iron. Its appearance led many dealers in gold to suppose it was spurious metal. Any particles dropped into an acid effervesced strongly. An uncommonly rare specimen. The specific gravity of this specimen was 11.7. (*)	—	0 0 5 0	0 5 0

REMARKS.

The following data are deduced by Mr. Birkmyre from the foregoing record:—1st. That gold in nuggets, even of large size, may be found on the very surface of the ground, as in No. 4, and at a depth of 400 feet, as in No. 14. 2. Gold in large masses may be found, as in No. 14, without a particle of quartz or any other non-metallic body. 3. Though it is usual to find with nuggets, quartz (oxyd of silicon), alumina (oxyd of aluminium), and rust (oxyd of iron), these solid bodies being the most abundant in nature, yet such gold is also found with substances which are not common, such as iron pyrites, black oxyd of manganese, and the very rare, salt carbonate of bismuth. 4. It is interesting to observe that where carbonate of bismuth has been found along with gold, as at Kingower, the same locality has yielded an unusual number of large nuggets. 5. That gold in large masses, as in No. 1, is almost as pure, viz., 23 carats 3½ c. grains, as the very finest gold dust, viz., 23 carats 3½ c. grains. 6. The purest nuggets, like native silver and iron, have never been found absolutely free from alloy, that is, chemically pure. 7. Silver and iron form the usual alloy of the purest gold in large masses, and these metals are also found in the purest gold dust. 8. The variety of substances recorded above, as accompanying masses of gold, seem to confirm the fact lately announced, that though gold be obtained almost invariably in the metallic state, yet, like silver and all the common metals, it may also be found as an oxyd—Dr. Percy, of London, having produced minute traces of gold from litharge (protoxyd of lead), white lead (carbonate of lead) and sugar of lead (acetate of lead), and I have, after many careful experiments, extracted gold from the red crystals of tin-ore (peroxyd of tin) found at the Ovens. 9. The largest mass of gold on record (No. 1) was found in Victoria in 1858; this pebble was almost twice as heavy and valuable as the great Russian nugget found in 1842, and four times that of the famous "grain of gold" found in Hayti in 1802. 10. As the largest lumps (pebbles Nos. 1 and 2) of gold ever known were discovered in Victoria, though not until six years after the gold discovery there, it is probable that still larger masses will yet be found.

LIST OF NUGGETS FOUND AT DUNOLLY AND ITS NEIGHBORHOOD (OVER 20 OZS.)
 COMPILED BY F. KNOX ORME, ESQ., P.M., WARDEN, ETC.—DUNOLLY, 7TH
 OCTOBER, 1867.

Weight in OZS.	Date.	Locality where found.	Depth at which found.	Name of nearest Quartz Reef.	Distance from same.	Character of Washdirt and Character of Bottom.
			feet.		yds.	
127	1854	Quaker's Gully - -	10	Quaker's Reef	50	Gravelly clay.
180	1855	Graveyard Hill, Burnt Creek	10	Graveyard Hill Reef	-	Coarse drift with large quartz boulders.
84	1855	Inkerman Lead				
220	1856	Inkerman - - -	14			
52	1857	Quaker's Gully - -	10	Quaker's Reef	50	Gravelly clay.
62	1857	Quaker's Gully - -	10	Quaker's Reef	50	Gravelly clay.
197	1857	New Year's Flat - -	14	- - -	-	Gravelly clay intermixed with sandstone.
168	1857	Foot of the Hard Hill -	16	- - -	-	Gravelly clay intermixed with sandstone.
35	1857	Foot of the Hard Hill -	16	- - -	-	Gravelly clay intermixed with sandstone.
180	1857	New Year's Flat - -	12	- - -	-	Quartz drift intermixed with fragments of sandstone.
84	1857	Nuggety Gully, Mollagul -	6	- - -	-	Gravelly clay.
22	1858	Quaker's Gully - -	10	Quaker's Reef	50	Gravelly clay.
117	1859	Quaker's Gully - -	10	Quaker's Reef	50	Gravelly clay.
25	1860	Spark's Gully, Mollagul -	10			
34	1860	Spark's Gully, Mollagul				
32	1860	Bigg's Gully, Mollagul -	15	Jones' Reef - - -	-	Gravelly clay; pipeclay bottom.
30	1860	Bigg's Gully, Mollagul -	15	Jones' Reef - - -	-	Gravelly clay; pipeclay bottom.
180	1860	Old Lead, Dunolly - -	40	Monday Morning Reef	400	Gravelly drift; sandstone and clay-slate bottom.
120	1860	Surface Gully, Mollagul -	surface	- - -	-	Red clay.
27	1860	Baker's Gully - - -	6	- - -	-	Blue clay with drift.
34	1860	Clodhopper Gully - -	5	- - -	-	Gravelly clay with ironstone boulders.
32	1860	Mosquito Gully - - -	14	- - -	-	Coarse drift with sandstone boulders and reef.
33	1860	Bigg's Gully - - -	surface	- - -	-	Red clay.
61	1860	Bigg's Gully - - -	surface	- - -	-	Red clay.
92	1860	Nuggety Hill - - -	16	- - -	-	Coarse drift and heavy sandstone boulders.
31	1860	Nuggety Hill - - -	10	- - -	-	Coarse drift and heavy sandstone boulders.
440	1859	Spark's Gully, Mollagul -	12	Sheoak Reef - - -	200	Gravelly clay with sandstone boulders; sandstone and clay-slate bottom.
28	1859	Spark's Gully, Mollagul -	12	Sheoak Reef - - -	200	Gravelly clay with sandstone boulders; sandstone and clay-slate bottom.
240	1862	Clover's Gully - - -	14	Windmill Reef	500	Gravelly clay; pipeclay bottom.
288	1862	Clover's Gully - - -	14	Windmill Reef	500	Gravelly clay; pipeclay bottom.
104	1863	Wilson's Lead - - -	15	Arvon Reef - - -	200	Gravelly clay.
56	1863	Scotchman's Gully - -	15	Windmill Reef	600	
56	1863	Scotchman's Gully - -	15	Windmill Reef	600	
52	1863	Clover's Gully - - -	14	Windmill Reef	500	
168	1863	Milkmaid's Flat, Inkerman -	6			
52	1865	Patchy Flat Hill - - -	60			
60	1865	Patchy Flat Hill - - -	60			
50	1865	Old Lead - - -	25			
520	1866	Nuggety Gully - - -	3	Belgian Reef		
73	1866	Nuggety Gully - - -	3	Belgian Reef		
247	1866	Nuggety Gully - - -	3	Belgian Reef		
123	1866	Nuggety Gully - - -	3	Belgian Reef		

Weight in ozs.	Date.	Locality where found.	Depth at which found.	Name of nearest Quartz Reef.	Distance from same.	Character of Washdirt and Character of Bottom.
			feet.		yds.	
204	1866	Nuggety Gully - -	3	Belgian Reef		
84	1866	Nuggety Gully - -	3	Belgian Reef		
170	1866	Gooseberry Hill - -	50			
27	1866	Gooseberry Flat - -	40			
78	1866	Gooseberry Flat - -	40			
35	1866	Gooseberry Flat - -	50			
32	1866	Gooseberry Flat - -	50			
30	1866	Gooseberry Hill - -	50			
33	1866	Gooseberry Hill - -	50			
52	1866	Little Chinaman's Flat -	15			
74	1866	Gooseberry Hill - -	50			
32	1866	Gooseberry Hill - -	50			
35	1866	Gooseberry Hill - -	50			
60	1866	Nuggety Gully - -	4			
90	1866	Nuggety Gully - -	4			
70	1866	Nuggety Gully - -	4			
120	1866	Old Lead - -	15			
50	1866	Pound Rush - -	30			
66	1866	Pound Rush - -	30			
32	1866	Moliagul				
60	1866	Gooseberry Flat - -	50			
70	1866	Gooseberry Flat - -	50			
50	1867	Gooseberry Flat - -	50			
44	1867	Gooseberry Flat - -	50			
31	1867	Old Lead				
50	1867	Gooseberry Flat				
50	1867	Gooseberry Flat				
63	1867	Gooseberry Flat				
40	1867	Pound Rush				
45	1867	Moliagul				
31	1867	Nuggety Gully, Old Lead -	surface	- - -	-	Red clay.
68	1867	Old Lead - -	40	- - -	-	Coarse drift.
168	1867	Old Lead - -	40	- - -	-	Coarse red drift.
84	1867	Old Lead - -	40	- - -	-	Coarse red drift.
47	1867	Old Lead - -	40	- - -	-	Coarse red drift.
54	1867	Snake Gully - -	40	- - -	-	Coarse red drift.
167	1867	Old Lead - -	40	- - -	-	Coarse drift.
216	1867	Old Lead - -	30	- - -	-	Coarse drift.
56	1867	Old Lead - -	30	- - -	-	Coarse drift.
30	1867	Old Lead - -	30	- - -	-	Coarse drift.
20	1867	Old Lead - -	30	- - -	-	Coarse drift.
31	1867	Old Lead - -	30	- - -	-	Coarse drift.
20	1867	Old Lead - -	40	- - -	-	Coarse drift.
105	1867	Old Lead - -	40	- - -	-	Coarse drift.
34	1867	Old Lead - -	40	- - -	-	Coarse drift.
22	1867	Old Lead - -	40	- - -	-	Coarse drift.
84	1867	Old Lead - -	40	- - -	-	Coarse drift.
120	1867	Old Lead - -	12	- - -	-	Coarse drift.
60	1867	Old Lead - -	40	- - -	-	Coarse drift.
24	1867	Shanty Jack's Gully -	25	- - -	-	Coarse drift.

Some of these nuggets were got from five to ten feet from the bottom, in the gravel.

The following nuggets, also, have been obtained at Dunolly or its neighborhood, but the dates or localities cannot be given with accuracy :—

2,952 ozs.*	297 ozs.	144 ozs.	100 ozs. (three)	60 ozs. (six)	40 ozs. (seven)
1,743 "	296 "	141 "	96 " (three)	58 "	37 "
810 "	288 "	140 "	90 " (three)	57 " (three)	36 " (six)
805 "	251 "	137 "	87 "	56 " (two)	35½ "
801 "	238 "	136 "	84 " (four)	55 "	35 "
600 "	230 "	131½ "	83 "	54 " (two)	34 "
588 "	227 "	130 "	80 " (four)	52½ "	33½ "
480 " (two)	207 "	125 "	78½ "	52 "	33 "
410 "	206 " (two)	122 "	76 " (two)	50 " (five)	32 " (two)
396 "	200 " (three)	121 "	72 "	49 "	30 " (six)
384 "	192 "	120 "	70 " (two)	48 " (four)	29 "
381 "	180 " (two)	112 "	67 "	47 "	28½ " (two)
361 "	168 " (four)	110 "	66 "	46 "	28 " (three)
323 "	161 "	107½ "	64 "	45 " (two)	27 " (three)
308 "	158 "	106 "	63 "	43 "	
300 "	150 " (two)	105 "	62 "	41 "	

* See Nos. 5 and 6 in Mr. Birkmyre's list.

Under date 21st October, 1868, and 11th January, 1869, Mr. Knox Orme reports as follows, respecting the nuggets lately found at the Berlin Rush, near Kingower:—

"I visited the rush on the 15th October, on which day the 24 lb. or 288 oz. nugget, being the largest up to that time found there, was brought in. I went carefully over both gullies, viz., Clelland's, the one first opened and so named after Alexr. Clelland, the prospector, who was the first to strike gold there on 21st August last, and the second called 'Fortunate Gully,' and in it the largest nugget was found. I send you the following particulars, which may interest you.

"The Berlin Diggings are distant about twelve miles westward of Inglewood and four from Kingower, and are on the Kingdaraar Creek, which flows into the Loddon, after a course of about twenty miles. The population on the 15th instant was about 400 persons.

"The sinking is from two to four feet, and the gold is found most irregularly and at most uncertain depths, viz., from an inch or two to about four feet.

"Clelland's Gully runs nearly east and west, and gold has been obtained there for about three-eighths of a mile in length, and, on the average, about fifty or sixty feet in width at present.

"Fortunate Gully runs nearly north and south, and gold has been found there for about a quarter of a mile in length by a breadth of about forty feet at present. The surrounding country is hilly. In both gullies the bottom is generally schist, and sometimes what is called 'mullock.' The diggings are south and west of and close to a farm or fenced paddock, the property of Mr. William Johns.

"Fine gold has been very recently found about two miles S.S.W. of Berlin, and the prospects promise very well.

"I also send you a list of the nuggets, so far as can be ascertained, which have been found at the Gipsy Diggings, Wattle Flat; but this I am sorry to say is not so accurate as that of Berlin, owing to the great disinclination of the miners to have their finds made public.*

* Mr. Orme says that he intends to obtain the fullest information respecting the larger pieces of gold which may, in future, be found in his district. Particulars relative to the depths at which the nuggets occur, the character of the stratum wherein they lie, and their position in the gutter, as well as their specific gravity, and a description of their appearance, would be valuable; and it would be well if other officers, having similar opportunities, would record their observations.

"NUMBER AND WEIGHT OF NUGGETS FOUND AT BERLIN DIGGINGS, NEAR KINGOWER,
UP TO THE 31ST DECEMBER, 1868.

ozs.			ozs.			ozs.		
87 nuggets weighing	1		2 nuggets weighing	17		1 nugget weighing	37	
48 " "	2		4 " "	18		1 " "	38	
41 " "	3		2 " "	19		2 " "	40	
21 " "	4		6 " "	20		1 " "	44	
18 " "	5		2 " "	22		1 " "	46	
15 " "	6		1 " "	23		1 " "	47	
7 " "	7		2 " "	24		1 " "	55	
13 " "	8		3 " "	27		1 " "	57	
8 " "	9		1 " "	28		3 " "	59	
7 " "	10		2 " "	29		2 " "	62	
4 " "	11		2 " "	30		1 " "	91	
4 " "	12		2 " "	31		1 " "	112	
5 " "	13		1 " "	32		1 " "	174	
3 " "	14		1 " "	33		1 " "	225	
3 " "	15		1 " "	34		1 " "	228	
3 " "	16		1 " "	36		1 " "	440	

"A great many nuggets have been found and disposed of at Berlin, respecting which it was impossible to get information.

"NUMBER AND WEIGHT OF NUGGETS FOUND AT GIPSY DIGGINGS, WATTLE FLAT,
NEAR DUNOLLY.*

ozs.			ozs.			ozs.		
1 nugget weighing	40		2 nuggets weighing	22		20 nuggets weighing	12	
1 " "	35		3 " "	20		82 nuggets weighing		
1 " "	32		4 " "	17		about 10 ozs."		
3 " "	30		5 " "	15				

It cannot be without interest to give some account of the smaller nuggets found in the alluviums on the goldfields. It is to be regretted that sufficient information has not been obtained in regard to the position which they occupied in the strata, and as to their character and general appearance, because it is only from a multiplicity of observations that we can arrive at any sound conclusions as to their origin.

The following table contains information respecting a few nuggets found in each district, but by no means comprises the whole. It is not intended by it to give even an approximation to the number. It is now quite impossible to give an account of even a tithe of these lumps of gold; but as the samples in the table are taken indiscriminately, and as the records have been made by many different persons at various times, and without the knowledge that all the facts would ever be gathered together, they possess a value which a systematic record made by one person, with perhaps a theory to support, would not have.

The facts appear to strengthen the conclusion that the nuggets have been broken out of reefs, and not formed by the electro-plating process in the alluviums.

* No record kept or obtainable as to nuggets under 10 ozs. Between 3,000 and 4,000 ozs. obtained in all.

LIST OF SOME OF THE SMALLER NUGGETS FOUND IN THE ALLUVIUMS, AS RECORDED
IN THE REPORTS OF THE MINING SURVEYORS.

Division.	Weight.	Locality.	Remarks.
	ozs.		
Blackwood	18	Long Gully - - -	Stuck fast in clay which had been thrown up to the surface.
	7	Long Gully.	
	23	Nuggety Gully, near Long Gully	Had about 4 ozs. of quartz attached to it.
	15	Nuggety Gully, near Long Gully	Quite free from quartz.
	12	Ballan Flat - - -	Found a few feet below the surface with several smaller nuggets, one weighing $1\frac{1}{2}$ oz.
Smythesdale	53	Phipps' Flat - - -	Discovered by Gunner and party.
	12	Wet Flat, opposite the Nugget Hotel	In very wet ground.
Steiglitz -	12	Old Bull Dog - -	With several small nuggets.
	10	Dolly's Creek - -	Several nuggets were obtained at the same place.
Big River	5	Fryer's Creek - -	With several other smaller pieces. Depth of sinking, from four to twenty feet.
	28	Fryer's Creek.	
	14 $\frac{1}{2}$	Fryer's Creek.	
	8	Fryer's Creek.	
Matlock -	9	Fryer's Creek.	
	87	Jordan River - -	Messrs. Gannon, Grogan, and Co. found this nugget in their claim on the Jordan River, close to the town of Jericho. About 20 ozs. of fine gold were got near it, all in gravel, from twelve to eighteen inches above the bed rock.
Heathcote	39	Argyle Gully - -	Found in ground previously worked and abandoned.
	33	Argyle Gully.	
	7	Argyle Gully.	
Raywood -	9	Red Hill - - -	Near a small vein of quartz half an inch thick.
	22	Welbaum Line of Reef -	Found at a depth of four feet, in the alluvium.
	6	Welbaum Line of Reef.	
Maryborough	275 $\frac{1}{2}$	Splitters' Gully, Whipstick	Nearly all gold—only a little ferruginous quartz.
	174	Gibraltar - - -	A mass of quartz and gold. There were 100 ozs. of clean gold, and the rest was quartz. Found at a depth of seventy feet. A remarkable specimen, the gold and quartz being curiously mingled.
	4 $\frac{1}{2}$	Arent's Hill, near Havelock	Found on the surface.
	6	Arent's Hill, near Havelock	Found on the surface.
	6	Havelock Flat - -	With many small nuggets. Found at a depth of twelve feet.
	14	Emu Lead - - -	At a depth of sixteen feet, with a quantity of fine gold.

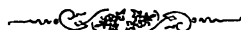
Division.	Weight.	Locality.	Remarks.
	ozs.		
Amherst -	360	Nuggety Gully - -	With a great many smaller pieces.
	8	Mount Greenock Lead -	With coarse gold.
	30 ¹¹ / ₁₆	Near Amherst Pound -	Seven and a-half inches in length, one and a-half inch in width, and a quarter of an inch in thickness.
Avoca -	40	Gullies near Avoca -	Nuggets weighing from 5 ozs. to 40 ozs. have frequently been found in the alluviums.
	20	Mountain Creek - -	With numerous smaller pieces. Depth of sinking sixty-five feet.
St. Arnaud -	22	New Bendigo Rush -	In washdirt from two to five feet in thickness.
	782	Evans' Gully, Glenalbyn	{ All found within a very small area, together with smaller pieces, weighing in the aggregate 200 ozs. It is believed that many more were obtained and not recorded.
	493		
	224		
	198		
	77		
	57		
	54	Pick and Shovel Flat. Garibaldi - - -	Sinking three to eight feet; thickness of washdirt twelve to eighteen inches; yield 6 dwts. to the load. Many small nuggets—weights not recorded.
	152		
	84		
Korong -	90	Kingower - - -	With many others, 10 ozs. and more. All found within one or two feet of the surface.
	300	Potato Diggings - -	Found at a depth of six and a-half inches. More than 3,600 ozs. in nuggets, varying in weight from 1 oz. to 300 ozs., were taken from the same place, at depths of three inches and two feet.
	124	Wisbeach Hill - -	At a depth of twenty-six feet.
	—	West and east of Korong	264 ozs. of gold in nuggets, some 1 oz. in weight, were found in shallow ground in one day by separate parties—one getting 120 ozs., and the other 144 ozs.
	18	Kingower - - -	On the surface.
	7	Kingower - - -	Near an abandoned shaft.
	11	Kingower - - -	With many others the size of a pea—in a stratum of gravel, depth thirty feet.
	11	Daly Lead - - -	At a depth of about 136 feet.
	27	Near Cumberland Reef -	With many smaller nuggets.
	3	Prior's Sandstone Reef -	With 32 ozs. of gold—all taken from the reef.
Taradale -	33	Victoria Gully, about one mile east of Taradale	{ With many smaller nuggets. Very pure gold, unmixed with quartz. Found on sandstone rock. Very little quartzose drift. A vein of non-auriferous quartz crosses the bed-rock.
	22		
	15		
	13		
	11		
	3 ¹¹ / ₁₆	Taradale - - -	With smaller nuggets and fine gold.
Maldon -	13	Nuggety Flat - -	With two other nuggets, 6 ozs. each. A party of four took out 500 ozs. in two months.
Fryer's Creek -	4	Fryer's Creek.	

Division.	Weight.	Locality.	Remarks.
	ozs.		
Hepburn -	384 } 277 }	New Nuggety Gully -	With many smaller nuggets.
	29	Billy the Drummer's Flat	Near Adam's Reef.
	46	Whiskey Lead - -	In a sluicing claim.
	26	Keep-it-dark Gully.	
	60		
	28		
St. Andrew's -	14	Stockyard Gully, Glen- gower	With many others of smaller weight.
	11	Happy Valley - -	With many others, from $\frac{1}{4}$ oz. to 11 ozs. Traced to a reef.
	84 } 42 }	Happy Valley - -	The 84 oz. nugget weighed 78 ozs. after smelting. 72 ozs. of small nuggets were found in the same claim within a few feet of the larger nugget. In the same gully one claim yielded £1,000 in three months, and two men got £200 worth of gold in two days. Supposed to be the richest gully in the Caledonian Goldfield.
	24 } 8 }		
	10	Fern-tree Gully - -	{ Fern-tree Gully, One-tree Hill, was very rich, and much fine gold was got, as well as several small nuggets.
	10		
	84 } 20 }		
Ararat - -	2	Picnic Gully - -	With many small nuggets.
Raglan - -	10	Sailor's Gully.	

NOTE.—It is possible that some of the larger nuggets in this list may be included in Mr. Birkmyre's tables.



Review of the Laws affecting Mining Interests.



The following brief review of the laws under which the miners have followed the pursuit of gold mining in Victoria, from the first discovery of gold in the colony up to the present time, has been prepared by John Atkins, Esquire, barrister-at-law.

As Revising Barrister to the Mining Boards, this gentleman has had many opportunities of studying the effects of mining legislation, and of observing the rather obscure questions ancillary to them. His account, therefore (brief as it is—yet a history), cannot but be highly interesting and useful in all countries where mining is an important industry.

Appended to his statement are lists of the Acts relating to mining which were passed by the Legislative Council and the Parliament of Victoria prior and subsequent to the coming into operation of the Constitution Act; the Bills introduced from time to time which bear on mining matters; and the several Acts relating to the Chinese.

These, it is hoped, will facilitate reference; and serve also to show the amount of care and attention which has been bestowed by the Legislature on the difficult questions which Mr. Atkins deals with.

His statement is as follows:—

A brief review of the laws by which the mining interests of Victoria have been from time to time affected, may not be uninteresting.

When, during the first half of the year 1851, the existence of gold in many localities throughout the colony became an established fact, and the rush of numbers crowded these localities with excited gatherers of the golden harvests, there was of course neither law nor ordinance to meet a state of things so unexpected and so suddenly appearing. The distant forces of the capital could neither guide nor control, and every miner did that which was right in his own eyes. He searched and dug for gold where he pleased without license or the thought of it, and the expenditure of the gold when won frequently produced scenes of riot and disorder. The Government of the day quickly saw that some steps must be taken for the management of these multitudes, that a police force must be provided, and some departmental machinery established peculiar and appropriated to the goldfields. Any such step would of course entail a considerable increase in the public expenditure; but this could easily be met, for, in view of the increasing quantities of gold which from day to day were received by the miners, it was thought reasonable that a portion of the profits of those who necessitated the expenditure should pay for their own protection and government. These reasonings gave origin to the first act of goldfield law in Victoria. This was a Government proclamation, which was issued on the 15th August, 1851, whereby it was notified that any person taking from any lands within the colony any gold, metal, or ore containing gold, or digging or disturbing the soil in lands then unalienated from

the Crown without being duly authorised so to do, should be prosecuted both criminally and civilly; and further, that regulations would be speedily prepared setting forth the terms on which licenses to search for gold would be granted on payment of a reasonable fee. This proclamation was shortly afterwards followed by another, stating that licenses to mine would be issued on payment of a fee of 30s. per month. For some reason, perhaps with a view to take advantage of this increasing wealth as a source of the colonial revenue, a *Gazette* proclamation appeared on the 1st of December in the same year, announcing that the license fee was to be thenceforth 60s. per month. This excited much opposition on the part of the miners; and on the part of the public in general it was objected that a power, thus suddenly and so seriously to alter the conditions under which a large proportion of the population earned their daily subsistence, ought not to rest in irresponsible hands. In consequence of these objections the proclamation was withdrawn.

On the 1st of July in this year (1851) the Colony of Victoria had become independent by her separation from New South Wales, and her Legislature assembled for the first time on the 22nd day of November in the same year. Amongst the measures to which that body first addressed itself, as of right belonging to the sphere of its duties, was the subject of mining. On the 6th January, 1852, an Act was passed—the 15th Victoria No. 15—declaring the conditions on which that occupation might lawfully be pursued. This Act, entitled "*An Act to restrain by summary proceedings unauthorized Mining on Waste Lands of the Crown*," enacted that any person mining or digging for *any* ore of any nature whatsoever without, or after the determination of, a license from the Governor in conformity with Government regulations, which were not however to increase the amount of the license fee payable at the time of the passing of the Act (which it will be remembered was 30s. per month), should forfeit for the first, second, and third and subsequent offences, respectively, sums not exceeding £5, £15, and £30, and the same penalties were imposed on persons carrying on any trade or calling on the waste lands without a similar license.

The second section of this Act empowered a Commissioner of Crown Lands, on the complaint of any licensed party that any person had encroached upon the portion of waste lands upon which such party was lawfully mining for ore, to proceed to the spot and enquire into the case, and on his own view or by evidence on oath to hear and determine the same in a summary way, and authorised him, if he found that an encroachment had been committed, to remove the encroaching person, his goods and chattels.

The third section empowered the commissioner to charge the party failing in any such dispute a fee not less than £1, nor more than £20, to be paid to the Colonial Treasurer, and applied to such charitable uses as the Governor should direct.

The fifth section empowered any commissioner, inspector, constable, or other person appointed by the Governor, to apprehend any person found offending against the Act (that is, mining without having obtained a license), and convey him before two or more justices to be dealt with as the Act directed.

The sixth section empowered a justice, upon oath made before him that any person had offended against the Act, to issue a warrant for his apprehension, and bring him before two justices to be dealt with as before. These two sections, the fifth and sixth, are particularly to be noticed, inasmuch as their operation has been a principal cause of those serious discontents and disturbances which subsequently took place on the goldfields.

The eighth section declared what should be considered "mining" in language much the same as that by which the term is defined by the Statute now in force ; but it excluded from the operation of the Act any preliminary search for ore or minerals, thereby exempting what is now called "prospecting" from the license fee, which remained as before, 30s. per month.

This was the first goldfield, or rather mining Act (inasmuch as it was not limited to gold mining alone), which was passed in the colony, its duration having been limited to two years. It contains eleven sections, and those eleven comprehend all that was then thought necessary of legislation on the two important divisions of the subject, namely, the management of mining interests and the administration of justice in relation thereto ; which divisions now form the subject of a Statute containing 246 sections, besides thirty schedules.

By the enactment of this measure the Colonial Legislature assumed a dominion over the gold in the colony which it did not possess. Later in the year of its passing (1852), the Colonial Minister at home affected to hand over to the Legislature of the colony the management of its gold mines ; but whether by that Act of the Home Minister the Colonial Legislature obtained any power over the gold, is at least doubtful. The Imperial Government, however, never advanced any objection.

We now pause, for a moment, to consider what was the effect of the legislation produced by this first Goldfields Act, premising that some little time after its enactment there appears upon the scene a body of officials called goldfields commissioners, headed by a chief commissioner, and which commissioners were entrusted with the duties imposed by the Act on the commissioners of Crown lands. These persons were, in some instances, little more than youths, and wholly inexperienced. To these, fit or unfit, as it might be, for judicial investigations, were entrusted the duties of deciding, by their own personal dictum, without the assistance of juror or assessor, disputes between miners, in cases where it was often mere oath against oath ; and to them and to the police was entrusted the duty of collecting the license fee. For a time this fee was not felt as a burden. The large gains of numbers and the larger hopes of others presented it at first as comparatively a trifle. But a change came upon the scene : gold gathering was after a while proved to be a lottery. The prizes were many and the winners were many, but the losers were many more. For these the spots of land they chanced to fix upon were barren, and the funds which brought them to the goldfields, and were to maintain them until the golden harvest was reaped, were nearly expended, but no harvest appeared. Still they must pay the license fee. Why, they asked, should it be the same for all, the successful and the unsuccessful ? This was the complaint of the poorer miners ; but there was a grievance beyond, which affected and irritated them all. The fifth section of the Act above noted empowered a commissioner to arrest any person found offending against its provisions, that is mining *without having obtained* a license. The commissioners seem to have construed this enactment as empowering them to arrest a miner who had not, at anytime at which a commissioner might choose to demand its production, his license about his person, wholly regardless of the question whether he had obtained one or not. This construction the commissioners carried out energetically. If the demand "show your license" was not promptly answered by its production, the offence against the Act was supposed to be committed. The statement that the license was at home, in the tent, was lost, or was worn into pulp by its continued retention in the pocket of a working dress, was of no avail. The convicted culprit was arrested, and marched to the lock-up, where he must stay until he could be brought before two justices. If circumstances

rendered it more convenient that a warrant should be issued for the arrest of a miner suspected to be unlicensed, then the sixth section of the Act was available. It became the practice of the commissioners and the police to go from claim to claim demanding from the miners the production of their licenses, and sometimes in an exasperating manner and tone. In short, the pastime of "digger hunting" became an established institution on the goldfields. Added to this was the harass caused by the frequently recurring times for the monthly payment of the fees, entailing loss of time and often long journeys to the office of the license dispenser. At this period the miners were not, at least directly, represented in the Legislature, and they said, or it was said for them, that if it were otherwise they would be relieved from their intolerable condition. A cry for political rights for the miners then arose from the friends of the people, and to this was added a cry for land for the miners from the enemies of the squatters. Perhaps a doubt as to the genuineness of these two last demands suggested to the Government a doubt as to the reality of the license fee grievance, and caused it to hesitate a while, until at last the voices from the goldfields grew too loud and fierce for neglect. The Legislature was now forced into action, and in September, 1853, a select committee of the Council was appointed to enquire into the case. This body, after the lapse of a few days, brought up a progress report, and in the urgency of the case recommended a temporary Act bearing on the license fee—17 Vict. No. 1—which accordingly was on the 14th day of September passed, and by which, after reciting that since the passing of the former Act the revenue from the gold mines was placed at the disposal of the Legislature, the Governor was empowered to issue licenses for gold mining for three months from the 1st day of September in that year, upon payment of a fee of 40s.

The select committee finally reported in the October following, and on that report was based the second Goldfields Act enacted in the colony, (not counting the previous temporary one)—the 17th Vict. No. 4—assented to on the 1st day of December, 1853. By this Act the two former Acts were repealed, and the Governor was empowered to issue licenses for one, three, six, or twelve months, which, subject to rules to be made, should authorize mining on waste lands of the Crown, *or such alienated lands as might be mentioned therein*; and the holder of the license was, subject to the rules, to be deemed (except as against the Queen) the owner of the piece of ground (called a claim) occupied by him by virtue of the license, no more than one such piece of ground being allowed to him. And the fees to be paid for the licenses were as follows:—For one month, £1; three months, £2; six months, £4; twelve months, £8.

Authority was also given to issue licenses to carry on the business of storekeeper on the goldfields, at the following rates:—For three months, £15; six months, £25; twelve months, £50.

The Governor was also empowered, subject to rules to be made, to issue leases of auriferous lands in consideration of a royalty, which was not to be less than one-twentieth of the gross amount of the gold produced. The commissioners were, subject to the rules, to determine the extent and position of claims and to mark them. Persons not having leases or licenses, mining or carrying on business, or residing on the goldfields, were subject to penalties ranging for the first, second, third, and every subsequent offence from £5 to £30. The provision in the first Act empowering the commissioners to arrest persons mining or residing on the goldfields without authority was continued in this Act, that power however being withheld from the police to whom it had been given by the former Act, and extended to the commissioners' assistants acting within their view. The commissioners' judicial power of deciding encroachment cases

was also continued; and the person encroaching was not only to be removed from the claim encroached upon, but made liable for the first offence to a penalty not exceeding £10, or imprisonment with hard labor for a period not exceeding two months, and for a second or subsequent offence to imprisonment with hard labor for a period not exceeding six months. The penalty for resisting a commissioner was raised from £10 to £50, with an alternative in the discretion of the justices of imprisonment with hard labor for a period not exceeding six months.

Two justices (not the commissioner) were empowered on a complaint of encroachment before them to cause any gold taken by the encroacher to be restored to its owner, and also to award, independent of this restoration, compensation to the complainant if he should prove that he had sustained any damage by the encroachment. To two justices also was given jurisdiction in mining partnership cases where the balance did not exceed £200.

The Governor in Council was authorised to make rules in respect of the leases and licenses, the extent of ground, and for what term, and on what conditions to be occupied, and the mode of obtaining or assigning the same; and the Act contains a provision similar to one in the former Act, excluding from its operation the pursuit of prospecting.

Under the powers conferred upon him by this Act the Governor made various regulations, founded apparently on those then existing in California, which again were in a great measure derived from the old Spanish gold-mining decrees. These regulations of the Governor were not much complained of. The extent of land allowed to each miner would now be a matter of ridicule, yet in the then condition of mining it was not a matter of much discontent. But a large part of the grand mining grievance was continued by the Act. It is true the license fee was largely reduced, but nothing in proportion to the wants of the poorer miners, and the mode of its collection remained as before. The digger huntings still abounded, and the constant and angry collision of the authorities with the miners, as well as the frequent evasions of payment of the fee were fast demoralizing the mining population. The other grievances of want of land and of the franchise were still proclaimed, in some cases perhaps with an honest feeling of the want; while there obtained amongst the miners a general sense that their complaints and interests were disregarded by the other classes in the community. Meantime the towns on the goldfields had assumed a more settled character, comprising intelligent persons more or less permanently settled. The opportunity given by this circumstance for public meetings, where the mining complaints could be discussed by assemblages and not by mobs, gave, in the language of the commission to be just now referred to, "a strength and definiteness to these complaints;" and at length the fierceness of the discontent culminated, in the close of the year 1854, in the Ballarat outbreak. This serious state of affairs forced the Government into renewed action, and on the 7th day of December, 1854, a few days more than a year after the last Goldfield Act had been passed, a commission was appointed to enquire into the condition of the goldfields.

Many suggestions were offered by this commission, and amongst others the total abolition of the license fee, and in lieu thereof, for the purpose of an acknowledgement of the public right in regard to the gold in the soil, the issue of a document to be called a "miner's right," at the charge of £1, and to be in force for a year; and, for the purposes of revenue, the imposition of a moderate export duty on the gold. The commission also recommended the abolition of the goldfield commissioners, and the appointment of officers to be called wardens, as also of local boards to frame bye-laws for gold mining.

In accordance with one of these suggestions of the commission, an Act—the 18th Vict. No. 27—was on the 20th day of April, 1855, passed, imposing an export duty on gold at the rate of 2s. 6d. on the ounce, and on the 12th day of June following was passed the third Goldfield Act—the 18th Vict. No. 37.

This Act, more extensive and elaborate in its provisions than either of the former, repeals the Act 17 Vict. No. 4, and provides for the issuing of “the miner’s right,” on payment of £1, by virtue of which the holder was to be entitled for one year to mine for gold, and to occupy for residence, so much of the Crown lands as should be prescribed by rules to be made under the Act. Business licenses were also to be issued on payment of £2 10s. for three months, £5 for six months, and £10 for twelve months.

The Governor was empowered to grant gold-mining leases, and to fix the rent or royalty to be paid in respect thereof, also to appoint officers who should have power to determine, and mark, the position and extent of claims; and he was authorized to make rules as to the form of these miners’ rights, licenses, and leases, the conditions upon which they were to be issued, and the mode of transferring them. The Act then gives to any justice the same power of deciding cases of encroachment as was by the previous Act given to two justices; and in addition, empowers either of the parties to the case, or the justice himself, to require that four assessors should sit with the justice, a majority of whom, consisting of the justice and two assessors, should decide whether any gold was taken or other damage committed; and if so decided, should order re-delivery of the gold and compensation to an amount not exceeding £200 to be paid for the damage. Previous to the hearing of the case the justice was empowered to demand a fee of £2 from the complainant, to be repaid to him by the defendant if he succeeded in his suit.

The Act then provides, in accordance with another suggestion of the commission, for the institution of local courts, and for this purpose authority was given to the Governor in Council to declare by proclamation any goldfield to be a district for the purpose of forming a local court, and to appoint the chairman of such court; every such court to consist of, besides the chairman, nine members holding miners’ rights or leases under the Act, and to be elected by persons resident in the district being holders of miners’ rights or leases. Power was given to this court to frame rules for determining the extent and position of claims, the conditions on which they should be worked, the application and use of machinery; and such local rules in relation to mining as the court should deem most beneficial; the rules not to be in force until assented to by the Governor and published in the *Gazette*, and to be laid before the Legislative Council within fourteen days from the making thereof.

The jurisdiction in partnership cases, which by the previous Act was given to two justices, was by this Act given to the local court, that jurisdiction being still restricted to £200.

This Act, which so reduced the price of the right to mine, and abolished the commissioner nuisance, gave for a time considerable satisfaction.

At the period of its passing may be said to have closed the first chapter in the story of Victorian gold mining, and with it a corresponding class of mining legislation. A lull began to be perceived in the stormy waters of agitation.

The fierce clamors for a justice believed to be wilfully withheld; the angry roar of infuriated passions, echoing from district to district, subsided, or were fast subsiding; and the laws which were subsequently passed were less for the purpose of removing grievances than for that of improving benefits possessed. The pursuit of

gold mining was becoming more settled, and defined into one of the recognized industries of the colony; and henceforth the legislation which affected it was to be regular and bestowing, instead of being fitful and little more than permissive.

Shortly after the passing of this Act the officers denominated wardens were appointed. They were chosen from the commissioners, who, taught by experience, were subdued into something of a more modest and capable character. Their duties were not, like their former ones, administrative, but executive; and to be performed in carrying out the rules of the local courts to be established under the Act. The first step to the erection of these courts was taken in the month of June of this year. By a proclamation of the 29th June, 1855, the Governor, in pursuance of the power conferred on him by the Act, proclaimed five districts to be districts for the purpose of forming local courts, namely, Ballaarat, Avoca, The Ovens, Castlemaine, and Sandhurst; and at the same time he appointed Messrs. Bull, Panton, Sherard, Turner, and Templeton to be the respective chairmen of the intended courts. As it was necessary that some time should elapse before the members of these courts could be elected and regulations passed by them, the Governor himself, on the same day as that on which the Act was passed, issued a system of regulations,* professing to promulgate them under the Act.

By these regulations the extent of ground to be occupied under business licenses and miners' rights was fixed, that for the former at eleven feet by thirty-three feet, and that for the latter at—for two miners twelve feet by twenty-four feet, for three miners eighteen feet by twenty-four feet, and for four miners twenty-four feet by twenty-four feet; no larger area being permitted unless where it could be shown that by a combination of two or more parties some natural difficulty, as for example flooding, could be overcome. Mining in beds of rivers was permitted if not injurious to the public. Water privileges were to be allowed by special sanction only. Persons discovering new goldfields were to be allowed double or treble the ordinary area. No miner was to be permitted to hold more than one claim; and a claim held unworked without some good excuse, as for example sickness, was to be considered relinquished. Leases of unworked alluvial ground not on an established goldfield, to the extent of forty acres at a rent of £10 an acre, were to be made to the prospectors who had discovered its auriferous character. The area of a quartz claim was to be twelve feet by twelve feet, and quartz-mining leases were to consist of 220 yards along the vein by the width of the vein, at a rent of £1 an acre.

These were the first regulations issued under the Act of 1855; and they are given here somewhat in detail, because they form the rudiments out of which have been developed almost all the regulations and bye-laws which have subsequently been promulgated over the Victorian goldfields in confusing abundance.

The first regulation made by a local court under the Act was made by that of Beechworth, which enlarged the size of the claim, when in flooded ground, to twenty-four feet by twenty-four feet per man. Subsequently to this period, and down to the end of the year 1857, the local courts made many regulations for their respective districts; and it may be said that the whole local legislation for the goldfields was in their hands. This legislation was directed principally to the following subjects, namely, the extent of the area of land which a miner was to be allowed to occupy under his miner's right, that area varying according to the nature of the mining,

* *Mining Regulations* under 18 Vict. No. 37. 12th June, 1855.

whether alluvial or quartz, the wetness or dryness of the ground, its lying or not in the bed of a river, and generally according to the greater or less difficulty of mining in the ground occupied; the manner in which the miner was formally to occupy and define the area of his claim, by posts or pegs, so as that each other miner might know that that area was not available for his occupation; the prevention of unlawful interference with claims; the requiring that a person who insisted upon a right to a claim in possession of another, either on the ground of some title in himself or of forfeiture by the other, should establish that right by legal process, and not, as was a common practice, by taking forcible possession of the claim, or, in goldfield phraseology, by "jumping" it; the modes of working so as to prevent collisions; the obligation to work so as to check the system of "shepherding," or the keeping formal possession of a claim without working it, until by the labor and expense of the neighboring miner it was ascertained that the auriferous lead existed in that locality; the determination of what should be a ground of forfeiture of a claim; the conditions under which water was to be used for mining purposes; the special privileges to be granted to successful "prospectors" or discoverers of new goldfields; and the protection from injury or nuisance by mining to public or private property. In all these respects the local courts more or less successfully carried out their objects. In some of them they occasionally exceeded the power of making rules which was vested in them; but if they had not done so many important cases, unforeseen by statutory legislation, would have been left unprovided for.

Meanwhile the mining interest was fast advancing in the colony; the numbers of the miners were increasing; rights became mutually involved and conflicting; and these and many other circumstances of the same nature gave rise to, and multiplied litigation. The local court regulations often, also, produced the same effect; the legality of many of them being questioned as being *ultra vires* of their framers. Moreover, the legal questions themselves were becoming more complex and difficult. The disputes between partners and members of companies (these becoming now for the most part associated under formal agreements and rules, often carelessly constructed) required the application of some of the most recondite principles of the law of partnerships. Furthermore, the jurisdiction, conferred on the two tribunals established by the Act of 1855, the magisterial one and that of the local court, was too restricted; and such jurisdiction as they had was often, in the altered circumstances of the goldfields, unmanageable in their hands, composed as they were of persons without legal habits or training, while the combination in the local courts of the rights of making and of administering their own laws was productive of effects which awakened, whether rightly or wrongly, suspicions of partiality and corruption.

Under these circumstances, it was felt that the time had come for another change in the mining law; that the modes of administering justice to the mining community should be improved, and the means of obtaining it enlarged. Accordingly, at the close of the year 1857, was passed the fourth Goldfields Act (21 Vict. No. 32), entitled "*An Act for Amending the Laws relating to the Goldfields.*" This Act, by which the previous one was repealed, and which came into operation on the 1st day of January, 1858, re-enacted the law as to miners' rights, increasing the privileges of the holders, by allowing them to cut timber on their claims for personal use and to make races and dams on any Crown lands for mining purposes, thereby making the right to water-privileges no longer, as under the previous system, dependent upon special permission. The system of business licenses was also re-enacted; and provision was made for compensation of the holders for improvements, in case the land which they occupied

should be sold. The Governor was authorised to grant mining leases for terms of ten years; and water rights and other easements; and to fix the amount of rent and royalty, and to make regulations as to the mode of obtaining these leases and rights.

The Act also empowered the Governor to erect portions of the colony into mining districts, such districts not to exceed six; and established in each district a court which was to be called "The Court of Mines," presided over by a judge who should be a barrister with the qualifications therein mentioned. The original, as distinguished from the appellate jurisdiction given to these courts was equitable. They were empowered to decide equitable questions concerning the title to land occupied under a miner's right, or comprised in a mining lease; and concerning contracts respecting such land, or gold to be taken out of it; and a jurisdiction in gold-mining partnerships was also given to them, no pecuniary limit being set to any part of this jurisdiction. In these courts there were to be no pleadings; but the clerk of the court in which a suit should be brought was to enter the complaint in a register, and issue a summons to the intended defendant. The trial was to be before the judge alone, unless either he or either of the parties required some fact to be tried by assessors.

The judge was empowered to grant injunctions, appoint receivers, order deposit for safe custody of gold in dispute, and production of documents; and a right of appeal was given to the Supreme Court of the colony from the judgments of the Courts of Mines. The Act then proceeded to establish a minor jurisdiction. This was conferred on officers called by the already known name of "Wardens." Power was given them to adjudicate in those encroachment or trespass cases which under the former Act were decided by justices; and they were also empowered to decide upon the rights of parties asserting a title to claims in the possession of others, either on the ground of forfeiture or abandonment by those others, or on any other ground. An appeal was to be allowed from the decision of the warden to the Court of Mines; and in order to guard against non-payment of the fee for the miner's right, it was enacted that no person could institute a suit in any court for recovery of land held under a miner's right, or of damages for the occupation of, or encroachment on such land, unless he held a miner's right when his alleged title to recover first arose.

The Act, having by the repeal of the former one abolished the local courts, established a new class of bodies called "Mining Boards," one for each mining district, consisting each of ten members. The districts were to be apportioned into such number of divisions as the Governor in Council should determine; and the ten members of each board were to be attributed to these divisions as the Governor should direct. The members were to be annually elected by the holders of miners' rights, resident in the respective divisions which the members were to represent. A sum of £500 was to be paid out of the public revenue to each board as remuneration for its services, and the boards were to choose their own chairmen instead of, as under the previous system, the chairmen being appointed by the Governor.

The duties of these boards were to be legislative, but not as previously, to some extent, judicial. They were empowered to make bye-laws for determining the quantity and form of land, to be called a claim, to be occupied by virtue of a miner's right; the events upon which a claim should be forfeited or deemed abandoned; the mode in which claims should be worked and assigned; the quantity and form of land for residence and business areas; also for the enforcing a system of registration of claims; for the regulating the mode in which the rights conferred by a miner's right were to be enjoyed; for the restricting or qualifying that enjoyment; and generally

such bye-laws as might be necessary for the protection of the holders of miners' rights and business licenses. A provision was made for the cancelling by the Governor of any bye-law shown to be improper.

The Act came into operation on the 1st January, 1858. Mining districts were proclaimed, mining courts erected, and judges appointed, and thereupon was founded a regular and special mining judicature.

By an Act passed on the 18th day of June, 1862 (the 25th Vict., No. 148), entitled "*An Act to amend the law relating to leases of auriferous lands and for other purposes*," the parts of the Act of 1857 relating to mining leases were repealed, and new powers of granting such leases, at rents not less than £2 10s. per acre, were conferred on the Governor. Power was also given to him to grant licenses authorising persons to construct races and reservoirs for mining purposes; and a machinery was established for obtaining and regulating these privileges, and determining the conditions upon which they were to be granted.

The Act of 1857, an undoubted improvement on the previous system, might have continued to satisfy the country if gold mining had remained stationary; but this it did not. Most of the surface and easily acquired gold had been obtained, and the mass of independent and unskilled miners working for themselves, who were attracted by it, were fast departing from an occupation which now was beginning to require, if it was to be profitable, co-operation, capital, and machinery; or they were absorbed as paid laborers into the mining companies now fast increasing. Individual efforts were thenceforward to yield to science and machinery; but these could not be had without capital, and were discouraged by the narrowness in some respects of the privileges afforded by a miner's right, especially the small portion of land permitted to be occupied under it: one of the heritages from the early dark ages of mining. A greater extension of the system of leases, a longer tenure under them, and a larger area comprised in them, were also called for. It was indeed doubtful whether the mining boards could not authorize the occupation under a miner's right of any quantity of ground; but the doubt existed, and ought to be removed. Further, the necessity for the production of a miner's right for each individual member of a mining company, in order to entitle the company to institute any legal proceedings, was frequently productive of injustice, inasmuch as many of such members would leave the district, taking their miners' rights with them; and objection was also made to the necessity of taking out the miner's right yearly.

The discordant and heterogeneous character of the local legislation, arising from the independent law-making powers vested in the respective mining boards, together with the crude and inartistic shape of this legislation, giving rise, it was urged, to perpetual disputes amongst the miners, formed also a subject of constant complaint; and a parliamentary codification of this legislation was urgently required. Another matter relating to mining, but not connected with previous legislation, had assumed, at this time, considerable importance. The question of mining in land alienated from the Crown had, prior to this period, from time to time more or less seriously occupied the public mind, and it was now pressed that that question should be settled. Improvements were also suggested in the administration of mining justice. Amongst these were the giving a common law jurisdiction to the judges of the Courts of Mines; the establishment in a single judge of the appellate mining jurisdiction, in the expectation that thereby might be founded a consistent code of mining jurisprudence; the introduction of written pleadings in the Courts of Mines; the enlargement of the jurisdiction of the wardens, and of their powers, particularly as to granting injunctions,

and the establishment of a mode of commencing proceedings before them more definite than the loose and oral mode which then existed.

The Act of 1857 was not long in operation before these criticisms upon it began to be heard; and at length they came to be so pressed that the Government was forced into action. It was thought advisable that the whole subject of mining should be again referred to a royal commission; and accordingly such a commission was, on the 8th day of July in the year 1862, issued to three commissioners, namely, Mr. Humffray, Professor McCoy, and Mr. Mollison. This commission immediately entered upon its duties, visited most of the goldfields of the colony, and obtained an immense mass of evidence upon all subjects relating to colonial mining. The report of this commission was published in the month of August, 1863, and it was thereby advised that amendments in the law should be made to a great extent in accordance with the abovementioned suggestions and complaints. Shortly afterwards an elaborately framed Bill, founded upon its recommendations, was brought into the Legislative Assembly by Mr. Sullivan, then Minister of Mines, and Mr. Higinbotham, then Attorney-General.

This Bill embraced the whole subject of mining, including mining on private property, and the codification of the bye-laws; but for various reasons, and, amongst others, the difficulty of dealing with these two last-mentioned branches of the subject, the Bill did not become law.

In the course of the year 1864 another Bill, not including these last-mentioned branches, and in other respects less comprehensive than the previous one, was introduced by the same gentlemen into the Assembly; and having, subject to much discussion, passed through all its stages, it was assented to on the 28th day of November, 1865. This Act—the 29th Vict. No. 291, styled the “*Mining Statute 1865*”—came into operation on the 1st day of January, 1866; and, together with the leasing regulations and bye-laws made under its authority, and an Act relating to Mining Companies to be noticed by-and-by, constitute the existing Mining Code of Victoria. It is divided into two parts: the first, regarding the management of mining interests; the second, the administration of justice in mining matters. It gives effect to some only of the recommendations of the Royal Commission of 1862. The system of mining boards with their independent legislative powers is continued; but in other respects alterations are effected by it, some of which, at all events, must be considered as improvements.

With regard to the miner's right: the Government is empowered to issue a miner's right to be in force, not merely for a year, but for any number of years not exceeding fifteen; and a document called a “consolidated miner's right,” and to be of the same variable duration, may be issued to the manager of, or to a trustee for, a company working claims registered under the Act, which document is to represent the number of single rights which would be necessary for the holding of the claims. The price of a single miner's right is reduced from £1 to 5s. per year of its duration; and that of a consolidated miner's right is in proportion. The quantity of land, whether in one or in many claims, to be held under a miner's right, is left to the judgment of the mining boards, who, by their bye-laws, are to determine what quantity of ground, whether in one parcel or in many, the holder of a miner's right is to be entitled to take possession of for gold-mining purposes—each such parcel being by the Act designated as a claim; and such holder has the privilege of using the water in the Crown lands for domestic and mining requirements, and to that end to construct races and dams. He is also permitted to occupy a quarter of an acre of land for residence, to use the timber on Crown land for fuel, and to use for both mining and building

purposes the timber, stone, and other materials found on the Crown lands. This title is assured to him so long as he complies with the provisions of the Act and the bye-laws as against all the world, except the Queen, and, except as against Her Majesty, all the gold which he raises is absolutely his. Furthermore, by a late Act—the 31st Vict. No. 306—the export duty on gold has been abolished, so that now the whole pecuniary benefit derived from the miner by the State in return for all these advantages is represented by an annual payment of 5s. The digger of the early days, with his ten feet of land, his £18 a year license, and the hunting commissioner behind him, could hardly have dreamed of the vast extent of the privileges which his successor was to enjoy. With a view to the identification of and greater security of titles to mining property, a system of registration of claims has been established by the Act. This, however, is not made compulsory, inasmuch as it was thought that its enforcement would be too burdensome on those miners who, still as of old, in appreciable numbers carry on their operations in isolated spots at great distances from the central goldfields, where convenience requires the registration machinery to be located. At the same time the Act encourages the adoption of the system of registration by all, by giving to those who do adopt it certain special privileges. These are the right to obtain the consolidated miner's right before mentioned; the right to divide interests in registered claims into transferable shares; and this further most important right, namely, that a claim so registered may be held during its whole existence as a claim by such number of miners' rights, or a consolidated miner's right representing them, as should be by the bye-laws sufficient to authorize the original occupation of the claim, no matter how many miners may by multiplication of shares, or otherwise, become interested in the claim. The value of this privilege consists in this, that while the revenue derived by means of the miner's right from a given piece of land is not prejudiced, inasmuch as that revenue remains always the same, the capitalist can advance his money to a mining speculation without the necessity of periodically remembering, or the risk of at any time forgetting, to obtain a miner's right. No doubt he will have to be satisfied that the number of miners' rights which is necessary for the holding of the claim is duly maintained; but this is a care which he may reasonably trust to the manager or active members of the speculation.

The system of granting licenses for carrying on business on the Crown lands within any goldfield is continued by this Act, but the rates of payment are reduced. By the previous Act the rates for six and twelve months were respectively £5 and £10. They are now half these sums respectively; licenses for three months not being any longer grantable. A license of this kind entitles the holder to occupy a quarter of an acre of land which, with the license, may, during its continuance, be transferred from owner to owner as any other property.

Lands applied to public purposes are exempted from mining, as also any specific portion of Crown lands which the Governor in Council may think proper to exempt; but, in either case, the exemption may be removed on proper grounds for the removal being shown. Provision is also made for mining under streets or roads, where it can be effected without injury to them.

The provisions previously existing as to mining leases are extended to mining, not merely for gold, but for any metal or mineral whatsoever. The rent payable for a gold-mining lease, which may be for a period of fifteen years, and of any extent of area is reduced from £2 10s. to £1 per acre. The area to be included in a lease for mining for any metal or mineral other than gold may be 640 acres, and such a lease may be granted for a period of thirty years.

Any person desirous to search for gold in places where sinking through basalt will be necessary, may occupy for the purpose of such searching one square mile of ground; and, on discovering within that area gold in remunerative quantities, he may obtain a lease of 100 acres of any part of the area, at a nominal rent, and for such term as the Governor shall determine.

The Governor is also empowered to grant licenses for searching in Crown lands for metals or minerals other than gold; also licenses to cut and construct races, dams, and reservoirs, with a view of supplying water for mining purposes; and he is authorised to make rules regulating the mode of applying for, and obtaining any of these leases or licenses.

By this Act, as by the immediately preceding one, the Governor is empowered to divide the colony into mining districts; to subdivide these into divisions; and to appoint mining officers, such as registrars and surveyors.

The local legislation in regard to mining under miners' rights is still, as already intimated, entrusted to bodies called, as under the previous system, "Mining Boards." The constitution of those boards is substantially the same as that of those previously existing, except that the members must, as well as their constituents, be holders of miners' rights or business licenses, and resident respectively within the division represented by them. Each board is entrusted with the power of making bye-laws for the district it represents. These bye-laws regard, amongst other matters, the quantity of ground which may be taken for a claim; the mode of taking possession of it, and of water rights; the enforcement and mode of working and using claims, and water rights; the determination of the events upon which mining interests shall be forfeited; the mode of transferring, and registering such interests; the enforcement and regulation of drainage in, and the pumping of water from, mines; and the disposal of waste and refuse water and sludge. The boards have also power to make various subsidiary regulations relating to the prevention of injuries to mining interests, the repairs of by-ways on the goldfields, the preventing of nuisances, and others of a like nature.

The portion of the Statute now under review—the "*Mining Statute 1865*"—noticed in the preceding remarks, is that which is comprehended under the first of the two parts into which, as already mentioned, the Statute is divided, namely, that which regards the management of mining interests. The second part relates to the administration of justice in mining matters. The principal alterations from the previous law effected under this head consist in an increase of jurisdiction given both to the courts of mines and to the wardens; and the establishment of an appellate mining court, the court of the chief judge of courts of mines, presided over by one of the judges of the Supreme Court, who, when sitting in his jurisdiction, is styled the chief judge of courts of mines, and by whom appeals from the ordinary courts of mines are decided. Mr. Justice Molesworth is the present chief judge.

These courts of mines possess now an original common law jurisdiction in mining matters, and not merely an equitable one as under the previous Act. The jurisdiction is in both cases unlimited as to amount in value of the subject matters of litigation. Suits are to be commenced, as before, by a plaint in writing, setting out the cause of complaint, a copy of which, with a summons endorsed on it, is to be served on the defendant. The suit may still be, as by the former Act it was required to be, prosecuted without written pleadings; but now, by leave of the judge, the pleadings may be in writing, and in this case they somewhat resemble the forms of pleadings in a suit in a court of equity. The judge of the court, and either of the parties, may require that any question of fact shall be tried by six assessors, the verdict of a majority of whom

is to be received, and the decree of the court is to be formally drawn up and filed with the pleadings, if in writing, in the office of the clerk. Regular provisions are made for the enforcement of decrees and orders of judges, and the judges are invested with an interlocutory jurisdiction, under which they may grant injunctions, without suit, against mining; may restrain proceedings at law where a court of equity can do so; may appoint managers of mining interests; may order deposit of disputed gold or other metals or minerals with the clerk of the court; and may enforce the production of documents. They have also a power to issue an order in the nature of a mandamus, commanding wardens and other mining officers to show cause why they should not perform some particular act required of them by a suitor, and alleged to be within their duty.

If on the hearing of a suit a legal question should arise upon which a judge may wish to obtain the opinion of the chief judge, he is enabled to do so by stating a case to be laid before the chief judge, who is to give his opinion thereon; and, as before mentioned, the chief judge is to hear and decide appeals from the courts of mines. On the whole, the administration of mining law in Victoria now exists as an almost separate and a regular and established jurisdiction; comprehending in mining matters nearly all that belongs to the Supreme Court, sitting as a court of law or of equity; its proceedings carried on with form and order, and sustained by a regular judicial machinery, not unnecessary, having regard to the magnitude in amount and importance of the property with which it deals. This magnitude will be estimated by remembering that the jurisdiction of the courts is unlimited, and by the fact that the questions in litigation before them frequently amount in value to many tens of thousands of pounds.

By this Act the judicial power of the wardens is also greatly enlarged; their jurisdiction now embracing all the common law jurisdiction of the courts of mines, together with certain limited powers in partnership cases. Proceedings are to be commenced before them by a summons to the defendant, which is to state the nature of the complaint, and not, as before the Act, by a mere verbal statement of it. The warden, or either of the parties, may require the complaint to be heard before him and four assessors; and he too, like the judges of the courts of mines, may state a case for the opinion of the chief judge. Suits are conducted before him with as much form as is consistent with the intention of his jurisdiction, as one of immediate access and prompt decision. He has certain special powers, under which he can order the inspection of claims, or lands comprised in mining leases, alleged or suspected to be encroached upon; can grant injunctions against mining, on notice to the parties interested; and in urgent cases, injunctions to be in force for seven days without notice; and he can, like the judges of the courts, order the deposit of disputed gold or other metals or minerals. Appeals from the decisions of the wardens lie to the courts of mines, the judges of which may, as in original cases before them, obtain the opinion of the chief judge on questions of difficulty, arising in the course of the hearing of the appeals.

The Statute contains also some miscellaneous and subsidiary provisions, and concludes with an enactment continued from the preceding Act, the policy of which has always been, and still may justly be, questioned.

By that enactment it is provided that no person shall be entitled to sue in a court of mines, or before a warden, unless he shall have been at the time when his cause of complaint arose the holder of a miner's right. This legislation was probably prompted by fiscal precaution; but when it is remembered that a miner may innocently forget to renew his miner's right for a few days after the expiration of a previous one, and that

in the interval the wrong may be committed which, unredressed, might involve the loss of a valuable claim with an amount of labor and expense, the accumulation, it might be, of many toilsome years; when this is considered, and also the difficulty a miner of the poorer class might sometimes experience in proving the existence of a lost, and, for all other purposes, a useless document, it may be at least questioned whether a law, which in such cases forbids the establishment of rights, is an equitable one, and whether any case of the non-possession of a miner's right, except in a case of fraud, would not be sufficiently met by the imposition of a pecuniary penalty, as under the English Stamp Acts.

The history of the mining law of Victoria could not be complete without a notice of a class of cognate legislation which regards mining companies.

That branch of the law of partnership, which makes every partner liable to the full extent of his means for the debts of a partnership firm, was at an early period in the history of the goldfields seen to offer a serious obstruction to the employment of capital in mining. Partly with a view to the remedy of this evil, an Act—the 18th Vict. No. 42—entitled “*An Act for the better regulation of mining companies*,” was passed on the 12th June, 1855, the day of the passing of one of the goldfield Acts before noticed. By this Act shareholders in a company formed under it were not to be liable for the company's debts beyond the amount of their shares. This Act was followed successively by two other Acts having similar objects, passed respectively the 4th June, 1858, and the 18th September, 1860; the first being the 21st Vict. No. 56, and called the “*Mining Association Act 1858*,” and the second the 24th Vict. No. 109, and entitled “*An Act to limit the liability of mining partnerships*.” These Acts may be dismissed without further notice, having been repealed, and possessing no interest such as may be found in reviewing the successive developments of the general goldfield law.

The Act now in force in Victoria, by which the liability of members of mining companies is limited, is the 27th Vict. No. 228. It is styled “*The Mining Companies Limited Liability Act 1864*,” and was passed on the 2nd day of June in that year.

This Act limits the liability of a shareholder in a mining company for the obligations of the company to the amount of his shares. It requires a company seeking the benefit of its provisions to become registered by a machinery which secures to the public knowledge of its financial circumstances, and of the number of shares held by each member. When registered the company becomes a corporation with a common seal; and certain powers of borrowing money, and of increasing its capital, are given to it. In case of its insolvency it may be wound up before a judge of a court of mines; and provisions are made for regulating the liability of past shareholders.

An Act entitled “*An Act to amend The Mining Companies Limited Liability Act 1864*” (31 Vict. No. 324) was assented to on the 6th September, 1867.

ACTS RELATING TO MINING, PASSED BY THE LEGISLATIVE COUNCIL OF VICTORIA,
PRIOR TO THE CONSTITUTION ACT, 19 VICTORIA.

- 15 Vict. No. 15. An Act to restrain by summary proceedings Unauthorized Mining on Waste Lands of the Crown. [Assented to 6th January, 1852.]
- 17 Vict. No. 1. An Act to alter an Act intituled "An Act to restrain by summary proceedings Unauthorized Mining on Waste Lands of the Crown." [Assented to 14th September, 1853.]
- 17 Vict. No. 4. An Act for the better Management of the Goldfields in the Colony of Victoria. [Assented to 1st December, 1853.]
- 18 Vict. No. 27. An Act for granting duties of Customs upon Gold exported from Victoria. [Assented to 20th April, 1855.]
- 18 Vict. No. 37. An Act to amend the Laws relating to the Goldfields. [Assented to 12th June, 1855.]
- 18 Vict. No. 42. An Act for the better regulation of Mining Companies. [Assented to 12th June, 1855.]

ACTS RELATING TO THE GOLDFIELDS, MINING COMPANIES, AND DUTIES OF
CUSTOMS ON GOLD EXPORTED, PASSED BY THE PARLIAMENT OF VICTORIA
SUBSEQUENT TO THE CONSTITUTION ACT.

- 21 Vict. No. 32. An Act for amending the Laws relative to the Goldfields. [Assented to 24th November, 1857.]
- 21 Vict. No. 56. An Act to facilitate the Formation of Mining Associations, and to amend and extend the provisions of an Act passed in the 18th year of Her present Majesty, intituled "An Act for the better Regulation of Mining Companies," and to render certain Preferable Liens and Mortgages of Personalty by Miners and Mining Companies valid without delivery, and for other purposes. [Assented to 4th June, 1858.]
- 22 Vict. No. 62. An Act to amend "The Mining Association Act 1858." [Assented to 17th December, 1858.]
- 24 Vict. No. 109. An Act to Limit the Liability of Mining Partnerships. [Assented to 18th September, 1860.]
- 24 Vict. No. 111. An Act to remove doubts as to the Validity of certain Mining Regulations and Bye-Laws. [Assented to 18th September, 1860.]
- 24 Vict. No. 115. An Act to amend an Act intituled "An Act for amending the Laws relating to the Goldfields." [Assented to 18th September, 1860.]
- 25 Vict. No. 135. An Act to amend an Act intituled "An Act for granting Duties of Customs upon Gold exported from Victoria." [Assented to 14th May, 1862.]
- 25 Vict. No. 142. An Act to Authorize the Exportation from the Colony of Victoria free of Customs Duty, of Gold not being the produce of the said Colony, and for other purposes. [Assented to 18th June, 1862.]
- 25 Vict. No. 148. An Act to amend the Law relating to Leases of Auriferous Lands and for other purposes. [Assented to 18th June, 1862.]
- 25 Vict. No. 153. An Act to amend the Law relating to the Drainage of Quartz Reefs. [Assented to 18th June, 1862.]
- 27 Vict. No. 228. An Act to Limit the Liability of Mining Companies. [Assented to 2nd June, 1864.]
- 28 Vict. No. 238. An Act to remove doubts as to the Validity of certain Mining Bye-Laws. [Assented to 23rd March, 1865.]
- 28 Vict. No. 275. An Act to amend an Act intituled "An Act to amend the Law relating to the Drainage of Quartz Reefs." [Assented to 15th June, 1865.]
- 29 Vict. No. 291. An Act to provide for the Management of and the Administration of Justice in relation to Mining Interests. [Assented to 28th November, 1865.]
- 31 Vict. No. 316. An Act to amend "The Mining Statute 1865." [Assented to 6th September, 1867.]
- 31 Vict. No. 324. An Act to amend "The Mining Companies Limited Liability Act 1864." [Assented to 6th September, 1867.]
- The duty on Gold exported from Victoria repealed after 31st December, 1867, by the Customs Duties Act 1867. [Assented to on 4th July, 1867.]

**BILLS INTRODUCED RELATING TO THE GOLDFIELDS, EXCEPTING THOSE PROVIDING
FOR MINING ON PRIVATE PROPERTY (for which see p. 181).**

Short Title.	Session.	By whom Introduced.
Gold Management (1) - - - - -	1856-7	Mr. Humffray.
Gold Management (2) - - - - -	1856-7	Resolution in Committee; motion; Mr. Haines.
Gold Management (3) - - - - -	1856-7	Resolution in Committee; motion; Mr. Humffray.
Export Duty Act Amendment - - - - -	1856-7	Mr. Ebdon.
Mining Machinery Mortgage - - - - -	1857-8	Mr. Grant.
Mining Association Act Amendment - - - - -	1858-9	Mr. Ireland.
Goldfields Act Amendment - - - - -	1859-60	Mr. Brodie.
Mining Partnerships Limited Liability - - - - -	1859-60	Mr. Pyke.
Frontage System - - - - -	1859-60	Mr. Serjeant.
Inspection of Mines - - - - -	1859-60	Mr. Carpenter.
Goldfields Management - - - - -	1859-60	Mr. Pyke.
Mining Disputes - - - - -	1859-60	Mr. Pyke.
Mines Inspection - - - - -	1860-1	Mr. Carpenter.
Mining Bye-laws - - - - -	1860-1	Mr. Frazer.
Gold Bill - - - - -	1860-1	Mr. Martley.
Gold Export Act Repeal - - - - -	1860-1	Mr. Woods.
Goldfields Management - - - - -	1860-1	Mr. Humffray.
Goldfields (Administration of Justice) - - - - -	1860-1	Mr. Ireland.
Gold Export Duty Act Amendment - - - - -	1861-2	Mr. Sullivan.
Goldfields Management - - - - -	1861-2	Mr. Humffray.
Gold Export Duty Act Amendment - - - - -	1861-2	Mr. McLellan.
Gold Export Duty Act Amendment (2) - - - - -	1861-2	Mr. Haines.
Quartz Reefs Drainage - - - - -	1861-2	Mr. B. G. Davies.
Gold Export Duty Exemption - - - - -	1861-2	Mr. Haines.
Gold Mining Leases - - - - -	1861-2	Mr. Wood.
Gold Fields Act Amendment - - - - -	1861-2	Mr. Wood.
Drainage of Quartz Reefs - - - - -	1861-2	Mr. Grant.
Mining Associations Act Amendment - - - - -	1862-3	Mr. Ireland.
Mining Boundaries Court Bill - - - - -	1864	In Committee.
Mining Companies Limited Liability - - - - -	1864	Mr. Frazer.
Quartz Reefs Drainage - - - - -	1864-5	Mr. Howard.
Mining Accidents - - - - -	1864-5	Mr. Carpenter.
Mining Bye-laws - - - - -	1864-5	Mr. Sullivan.
Mining Law Amendment Bill - - - - -	1864-5	Mr. Sullivan.
Mining Leases Law Amendment - - - - -	1864-5	Mr. Gillies.
Mining Companies Law Amendment - - - - -	1867	Mr. McCulloch.
Mining Companies Limited Liability Amendment (2) - - - - -	1867	Mr. Higinbotham.
Mining Statute 1865 Amendment - - - - -	1867	Message from Legislative Council; motion; Mr. Macgregor.
Inspection of Mines - - - - -	1867	Mr. Macgregor.
Mining Statute 1865 Amendment (1) - - - - -	1867	Mr. Casey.
Mining Tenements Protection Bill - - - - -	1868	Mr. Kerferd.

ACTS RELATING TO THE CHINESE.

- 18 Vict. No. 39. An Act to make provision for certain Immigrants. [Assented to 12th June, 1855.]
- 21 Vict. No. 41. An Act to regulate the residence of the Chinese Population in Victoria.
[Assented to 24th November, 1857.]
- 22 Vict. No. 80. An Act to consolidate and amend the laws affecting the Chinese emigrating to or resident in Victoria.
[Assented to 24th February, 1859.]
- 25 Vict. No. 132. An Act to amend an Act intituled "An Act to consolidate and amend the laws affecting the Chinese emigrating to or resident in Victoria."
[Assented to 19th March, 1862.]
- 27 Vict. No. 170. An Act to amend an Act intituled "An Act to consolidate and amend the laws affecting the Chinese emigrating to and resident in Victoria."
[Assented to 30th June, 1863.]
- 27 Vict. No. 200. An Act to consolidate the laws affecting the Chinese emigrating to or resident in Victoria.
[Assented to 20th April, 1864.]
- 28 Vict. No. 259. An Act to amend the laws affecting the Chinese immigrating to or resident in Victoria.
[Assented to 9th May, 1865.]

Chinese Protection Tickets were first issued to Chinese under the provisions of 18 Vict. No. 39 (assented to 12th June, 1855), at the rate of £1 per annum each. The first issue of protection tickets was made in June, 1855. The Act authorising the issue of protection tickets to Chinese was repealed on and from 28th February, 1859, by 22 Vict. No. 80 (assented to 24th February, 1859).

Chinese Residence Licenses were issued on and after 1st January, 1858, under Act 21 Vict. No. 41 (assented to on 24th November, 1857), and the rate was £1 each for two months. The Act 22 Vict. No. 80 (assented to 24th February, 1859) altered the rate for the Chinese residence license to £4 each per annum payable quarterly. This was in lieu of all other charges, dues, or imposts, except the fee for business licenses, and the fee on entering the colony as an immigrant. The Act 25 Vict. No. 132 (assented to 19th March, 1862) abolished the Chinese residence license.

The Chinese Capitation Tax was imposed on and after 1st November, 1855, by Act 18 Vict. No. 39 (assented to 12th June, 1855), and the rate was £10 for each Chinese immigrant arriving in the colony by ship. The Act 22 Vict. No. 80 (assented to on the 24th February, 1859) made an alteration, reducing the tax from 28th February, 1859, to £4 each in the case of Chinese immigrants entering the colony by any other way than by ship. Act 27 Vict. No. 170 (assented to 30th June, 1863) suspended the levying of the capitation tax on Chinese immigrants entering the colony for the period of two years. Act 27 Vict. No. 200 (assented to 20th April, 1864) re-imposed, from on and after 30th June, 1865, the capitation tax at the rate of £10 for each Chinese immigrant arriving by ship, and the rate was £4 on each immigrant entering the colony by any other means. The capitation tax was abolished by Act 28 Vict. No. 259 (assented to 9th May, 1865).



Supply of Water to the Goldfields.

Some time elapsed before the miners became aware of the value of a stream of water. In 1851 and 1852 they washed the rich gravels in the nearest pools, and, as there were numerous long reaches of water in the beds of the streams, the difficulties in their way were few. But when the discovered goldfields were completely opened up, when large areas of shallow drifts were turned over, and winter floods came and filled the old holes with sludge, and summer came and dried up the sludge lakes, it became necessary to seek for pure water at the sources of the streams ; and not alone for the purpose of washing the drift in the old-fashioned methods, but also for sluicing.

The miners who had gained experience in California were the first to explore the ranges, to take levels, and to construct races ; and the example they set was followed by others.

At Ballarat and in the Daylesford District many long races were cut, and some reservoirs formed ; but the most important works were constructed in the Beechworth District.

There were no laws in force, when these works were undertaken, under which the miners could gain a secure tenure of the lands which they occupied. In 1853 the gold was got mainly from the beds and banks of the streams ; and whenever a miner found that he could work his claim more efficiently by sluicing, he constructed a race, and asked the local commissioner for a *permit*. This permit was given by the commissioner *ex mero motu*, and a great number of equitable rights were consequently acquired. The permits were granted often without sufficient care, or at any rate in such a manner as to leave in doubt the extent of the privileges conferred. A number of men obtained permits authorising them to take water from a stream, and though these permits were numbered, perhaps, and the first, second, third, and successive rights made clear enough, conflicts commenced as soon as the holder of any permit changed the scene of his operations, occupied a bank claim in lieu of a claim in the creek, or diverted the water he was authorised to use into another drainage area.

Notwithstanding that the state of the law was unsatisfactory, as regards the diversion of water by Crown tenants, the gold regulations, the local court rules, and the bye-laws* were framed as if the conditions under which such rights could be established had been sanctioned by law.

* See *Gold Regulations*, 5th April, 1853, 31st December, 1853, 12th June, 1855, and 3rd October, 1855 ; *Beechworth Local Court Rules*, 4th October, 1855 ; and *Bye-laws Regulating Mining Operations in the Beechworth District*, 24th April, 1858.

During a period of nearly seven years the miners had been cutting races and executing other important works for conveying water, under permits and grants issued in accordance with the provisions of the bye-laws; thousands of pounds had been invested in this kind of property; and all believed that the rights in races and reservoirs were as secure as their titles to claims; but their confidence was at length rudely shaken.

In August, 1858, His Honor Judge Cope, in the case of *Hooper v. Mayzen*, expressed an opinion to the effect that the use of water and the diversion of water were illegal, if such water was taken from a creek or a river running through alienated lands, or lands lawfully held for mining purposes.

This opinion had an effect in all cases where it appeared very closely to apply, and where it was believed opposition would be made to the diversion of water; but in other places races were cut and rights were established under the bye-laws much in the old way. The miners felt that they acquired *some* rights by entering upon and occupying Crown lands for the purpose of cutting races and diverting water; and they looked forward to a time when the law would be amended.

Under the system as originally established, the miners pursued a wasteful method of diversion. Each took water where he could get it. Races were marked out and cut parallel to one another, and close together.

Very rarely were attempts made to conserve the winter rains, and in the dry season many of the races were useless. The storm waters ran to waste; and the drainage areas near Beechworth were so completely intersected with races, and so many rights were established, that it was almost hopeless to expect that any plan would be devised whereby the waters of these would be fully utilized.

Still further to complicate matters, the miners made tunnels into the hills to tap springs. In some localities, where the conditions were suitable, this was, properly enough, encouraged; but very soon tunnels were made at such levels as to take water from the creeks and from races; and disputes and difficulties, of necessity, followed.

Race-holders, too, having permits authorising them to take and divert a certain quantity of water, endeavored to increase the supply by turning into their races at various points along their course waters which would naturally flow into the creeks; and attempts were continually made to obtain a control over *tail-water*, to the injury and annoyance of other claimholders.

Looking at the authority under which races were originally occupied, it is obvious that the claimholder had granted to him only an easement—a privilege. It is true that he has from time to time endeavored to strengthen his title. The water diverted in the first instance in order to work a particular claim then in his occupation, was subsequently used to work some other piece of ground. Afterwards he ceased to be a miner, or continued to be so only in name; but believing that he had an exclusive right to the enjoyment of the water over which he had had control for a long period, he did not hesitate to sell it; and in this manner, by slow growth as it were, the claimholder was transformed into an owner of water. Regarding his own interests, entirely indifferent to the wants and requirements of the miners, and not hesitating when necessary to encroach on their privileges, the race-owner was looked upon with jealousy and distrust. He, believing that he had an equitable if not a legal right to the water, was exacting; and the miner, knowing the nature of the title, was not slow to avail himself of its weakness, and to thwart and annoy him by damaging his race and diverting the water. Hence arose disputes and litigation.

The insecurity of the titles, the injury to legitimate mining operations by the improper diversion of water, the necessity for giving due encouragement to capitalists to store water and convey it to the miners, and the difficulties under which race-owners labored, were at length pressed on the attention of the Government; and after proper enquiry, an amendment was made in the law.

The Act 25 Vict. No. 148 (18th June, 1862), conferred authority to grant licenses for any term not exceeding fifteen years, and gave power to the holders thereof "to cut, construct, and use races, dams, and reservoirs through and upon any Crown lands, whether the same shall or shall not have been demised," and "to take or divert water from any spring, lake, pool, or stream situated or flowing upon or through or bounded by any such Crown lands, in such manner as shall be prescribed by such license * * * * * in order to supply water for gold-mining purposes to such person or any other person who may be engaged in mining for gold; and it shall be lawful for the person to whom any such license shall be granted to take or divert water to the same but no greater extent as and than he might do if he were the owner of such Crown lands."

Under the 19th section of the same Act power was given to the Governor in Council to make regulations prescribing the amount of rent or royalty or the fee to be paid by licensees, the form of licenses, the conditions upon which such licenses should be issued, and the privileges to be enjoyed under them.

Regulations were accordingly issued on the 22nd December, 1862. Amongst other things it was ordered that the land to be used under a license for a race should not exceed an area of four acres for every mile in length of such race. The area was fixed, and not the width, because it was seen that it might be necessary at some points presenting engineering difficulties to occupy a considerable area. It was not necessarily implied that the land granted for a race was to be thirty-three feet in width. The rents to be paid were as follows:—For every race such sum as shall be considered proper, having regard to the quantity of water and the expenditure necessary, but not less than £5 per annum; and for every reservoir 10s. per annum for every 1,000,000 gallons of water, according to capacity. Under the general conditions the licensee was required to construct reservoirs in concert with other licensees, if such should be required, and if the physical character of the surface of the drainage area admitted of the construction of reservoirs. If the water should become diminished to a quantity less than sufficient for all the licensees, then the several licensees were to be entitled to take water in the order of priority of dates of their respective grants; leave was taken to provide for the construction, at the cost of the licensees, of proper bridges, crossing places, &c.; and power was reserved to the Governor to revoke any license, and to resume possession of the land, upon payment to the licensee of the value of his outlay, and such per centage thereon, not exceeding £50 per cent., as might be just, having regard to the value and state of repair of the works. A great many licenses were applied for under these regulations, but they were not at first so readily taken out as might have been expected. There was nothing in the Act defining the privileges of the licensee in a manner so exact as to satisfy him that his license would override permits granted by the Commissioners for the Goldfields and under the Bye-laws, and from time to time doubts were expressed as to the value of the licenses so issued. They were an improvement on the old system. Under the *permits*, and the system of occupation and diversion under the Mining Board Bye-laws, the rights conferred (if any) were vague. There was no map or plan, and the few words by which the miner was authorised to cut a race and divert water were not

sufficient to connect the "right" with any area of land. The licenses, on the other hand, were clear and distinct; the conditions were fully and fairly stated, and an accurate plan on a scale of from two to eighty chains to one inch was endorsed on the grant.*

Under the "*Mining Statute 1865*" (which repeals previous Acts †) larger powers are conferred. Licenses shall be issued by the Governor in Council; and the owner of a race or a reservoir who holds a license can recover in a summary way before a justice any sum of money due in respect of water supplied for the purpose of mining.

The many difficulties which surrounded the question of the diversion of water by claimholders whose interests conflicted, and the impossibility of ascertaining the equitable claims of applicants for licenses without some close investigations on the spot, induced the Government to appoint a Board to enquire into and report upon applications for water rights in the Beechworth District, where the applicants were most numerous, and where it was likely that all the graver questions connected with the administration of this branch of the Mining Department would present themselves. This Board ‡ examined the races at Beechworth, heard the statements of applicants, and received many useful hints from the lawyers who practise in the courts in that district, and framed a report on which new regulations, in all respects clearer and more suitable to the wants of the miner, were drawn and promulgated.

The new Regulations are dated the 15th July, 1867.

The miners have availed themselves of the privileges offered; and it is satisfactory to be able to state that all the difficulties (once thought insurmountable) have been overcome.

The minute subdivision of water in the Beechworth District, the diversion of it by numerous parallel races, and the consequent loss by percolation and evaporation of great quantities of water, are evils which cannot at present be remedied; but all that could be done by legislation has been done; and in due time, when existing interests are extinguished, better means of supplying water will be devised.

Tables No. 40 and 41 give information respecting the races which have been constructed by private enterprise in the colony; table No. 42 shows the number of water-right licenses granted; and table No. 43, the reservoirs constructed by the State.

In 1860 a vote of £50,000 was passed by the Legislative Assembly for the construction of reservoirs on the goldfields. At that time it was difficult to obtain the services of experienced engineers. The sum was too small to admit of the formation of a department to which could have been attached three or four persons who could have given their whole time to the business, and the Government was compelled to rely on such assistance as the local district and mining surveyors could afford. The time, too, within which the surveys and plans had to be made, was limited—only a few

* Report of the Board appointed to enquire into the subject of water rights at Beechworth.

† The Acts are repealed, but the rights acquired under the bye-laws and the regulations remain. Some races are now held under *permits*, granted twelve and thirteen years ago, and many under licenses issued in accordance with the provisions of the Act 25 Vict. No. 143, and the "*Mining Statute*." It is pretty generally admitted that no legal sanction was given for the diversion of water for mining purposes until the passing of the Act 25 Vict. No. 148. The race-owners have lately sought to get licenses under the "*Mining Statute*."

‡ The members were—the Honorable G. V. Smith, M.P. (now Postmaster-General), William H. Gaunt, Esq., P.M. and Warden; Peter Wright, Esq., Engineer for Water Supply, and formerly Chairman of the Mining Board; and the writer of this paper. The Report is dated 24th January, 1867.

months—and the difficulties in the way of selecting good sites were of necessity many and grave. These difficulties were, however, to a great extent overcome. The surveyors worked diligently; and a scheme for the distribution of the vote was suggested which would undoubtedly have given satisfaction, because only such sites were selected as would have admitted of future extension. That is to say, the larger schemes were selected, and it was proposed to construct banks which, in the event of any further sums becoming available, could be raised in height, and the capacities of the reservoirs thereby increased. But the local bodies in the several districts insisted on certain sites being chosen, and craved for a distribution of the vote in equal proportions; and in meeting their demands some obvious advantages had to be disregarded.

A fresh distribution was made; and though not so good as the first, it would have resulted satisfactorily in all respects, if funds had been promptly provided for conveying water to the spots where it was required. This was not done. More than thirty-five reservoirs—some of them containing 80,000,000 gallons of water—were constructed speedily, and without any serious accident; and they stand at this time as evidences of the care bestowed on their construction. In no case, whether held by local bodies or by the State, can it be said truthfully that they have not well repaid the original outlay; if not always directly by the returns for the sale of water, certainly indirectly by the advantages conferred on those residing in the vicinity of them.

The average cost of the works was £69 2s. per million gallons.

The revenue derived directly from the sale of water has been small, owing to the works having been left incomplete; and the various local bodies have always shown a reluctance to undertake the management of the reservoirs, in cases where they were unfinished and in such a state as not to admit of their being made at once a source of revenue.

In several cases the apathy of the local bodies has resulted in loss and injury. At Inglewood the inhabitants for a long period neglected to make available the water in the public reservoirs; and it was not until—by a disastrous fire—more than £80,000 worth of property was destroyed that they awakened to a sense of their responsibilities. If pipes had been laid down, and they would have cost no more than £600 or £700, the town would have been saved.

At another place, where there is a fine reservoir, the inhabitants have paid at the rate of three shillings per head per week for bad water for some six or seven years; although by expending £300 for pipes they could have had a plentiful supply of good water at a very small cost. The Honorable the Minister of Mines lately showed that the investment would return something like 75 or 100 per cent.

And yet nothing has been done, and nothing will probably be done as long as there is the smallest hope of obtaining money from the public funds.

The more spirited and energetic among the public bodies at once gladly sought and obtained the control of the public reservoirs, and under their management they have proved successful.

The purchase by the Government of Kirk's Reservoir, at Ballaarat, and the subsequent transfer of that work to a local commission, formed the commencement of a scheme of water supply for the town and goldfields of Ballaarat, which, when it is completed, will probably exceed in value and importance the magnificent works at Yan Yean, from whence the inhabitants of Melbourne are supplied.

In order that trustworthy information may be available as to the value of water on the goldfields, I have collected facts from all parts. It is not within the scope of

this work to enter into the details of the schemes, or to describe the works which have been constructed; but it is designed to show, from figures, which will bear scrutiny, that the common estimates of the results which will accrue from a large supply of water are not exaggerated.

Respecting the works at Ballaarat, Mr. H. Wood, the district registrar, makes the following statement:—

“BALLAARAT WATER SUPPLY.

“*Dams.*—Kirk’s Dam—area, seventeen acres; capacity, 106,000,000 gallons. Harry Beale’s Dam—area, eighty-one acres; capacity, 150,000,000 gallons; Pincott’s Dam—area, thirty-two acres; capacity, 36,000,000 gallons. Proposed new dam at Fellmongers’ Village—area, 200 acres; capacity, 1,000 to 1,200 millions of gallons.

“*Races.*—Aggregate length of races, twelve miles.

“*Mains, &c.*—Aggregate length of mains (eighteen inches diameter), four miles and forty-nine chains. Aggregate length of street mains (from three to nine inches diameter), thirteen miles. Aggregate length of service-pipes, about 62,320 feet.

“*Cost of Works.*—The total cost of works to the present date is £70,000, including the Government grant of £10,000, and £15,000 from the Government Water Works Loan, the remainder having been raised by means of a loan upon a special rate and by the revenue from the sale of water.

“*Revenue.*—The revenue from water supplied by meter, for the half-year ending 30th September, 1867, is as follows:—

No. of Meters.	Consumers.	Quantity. galls.	Rate per 1,000 galls.		Amount.		
			s.	d.	£	s.	d.
21	- Mines - - -	35,082,000	at 0	9	-	1,315	11 6
45	- Manufactures - - -	2,934,000	„ 3	0	-	440	2 0
31	- Domestic - - -	426,000	„ 4	0	-	85	4 0
7	- Government establishments	906,000	„ 2	6	-	113	5 0
2	- Baths - - -	79,000	„ 1	0	-	3	19 0
Arrears, representing about 4,000,000 gallons					-	207	1 0
						2,165	2 6
Revenue for the half-year ending 30th September, 1867, from water supplied by valuation, at from three to six per cent. on the annual value of premises					- - -	1,131	10 6
Revenue for the half-year ending 30th September, 1867, from the stand-pipes, at which water is sold at one shilling per load of 120 gallons					- - -	1,695	14 0
Total revenue for half-year					- - -	£4,992	7 0
The revenue from sale of water—							
For the year ending 30th June, 1863					- - -	3,032	16 0
For the year and a quarter ending 30th September, 1864					- - -	4,454	16 2
For the year ending 30th September, 1865					- - -	3,742	10 7
For the year ending 30th September, 1866					- - -	5,909	5 7
For the year ending 30th September, 1867					- - -	7,526	15 7
						£24,666	3 11

Estimated revenue for the current year—

From Mines	-	-	-	-	-	-	-	-	3,692	0	0
Domestic	-	-	-	-	-	-	-	-	2,500	0	0
Manufactures	-	-	-	-	-	-	-	-	800	0	0
Stand-pipes	-	-	-	-	-	-	-	-	2,600	0	0
									£9,592	0	0

The price of water for manufactures has been reduced for the current year from 3s. to 2s. per 1,000 gallons.

"Consumption.—The consumption for the half-year ending 30th September, 1867, was as follows:—

									Gallons.
By meter	-	-	-	-	-	-	-	-	43,427,000
By valuation	-	-	-	-	-	-	-	-	10,000,000
By stand-pipes	-	-	-	-	-	-	-	-	4,069,680
									57,496,680

No charge is made for the water used for watering streets, and no account is kept of the quantity used. The number of consumers by valuation, on the 30th September, 1867, was 972, the present number is 1,450; so that the quantity of water consumed this year will far exceed that consumed during the past year.

"The foregoing statement is based upon information given and documents supplied to me by officers of the water commission.

"In consequence of some portion of the rates for water supplied by meter not having been paid, I have been unable to ascertain from the secretary in what proportions the water (say about 4,000,000 gallons) was consumed by the several classes of consumers by meter."

The scheme for the supply of water to the Sandhurst Goldfields projected by the Bendigo Water Works Company*, but not up to the present time fully elaborated, is not without some features of interest.

According to information furnished by the secretary, it appears that one of the reservoirs is constructed to hold 67,000,000 gallons, and there is usually about 50,000,000 gallons stored in it.

The company filters about 150,000 gallons per diem, and this is distributed for domestic use, for breweries, manufactories, the goal, hospital, benevolent asylum, public offices, railways, &c.

The rates charged by the company are as follows:—

FOR DOMESTIC USE ONLY.

Where the annual value of the tenement does not exceed £50	-	-	7 per cent.	With water-closet or bath	-	8 per cent.
Exceeding £50, and not exceeding £300	-	-	6	"	"	7
Exceeding £300	-	-	5	"	"	6

* Under the Act 21 Vict. No. 69.

Where horses and cattle are constantly kept, the charges as follow to be in addition to the house rate :—Horses 24s. per head per annum ; cows 18s per head per annum ; and for livery stables and hotels, for each stall, 18s per annum, but not to include water for washing carriages ; for this an additional rate to be charged.

The above rates to cover a supply from service-pipes not exceeding half-an-inch bore.

Larger services according to agreement.

Payments to be made quarterly in advance.

Water delivered at the stand-pipes, 2s. per load of 100 gallons.

LARGE CONSUMERS BY METER.

(Parties consuming less than 25,000 gallons per quarter not to be considered as large consumers.)

Not exceeding 50,000 gallons per quarter -	-	-	5s. od. per 1,000 gallons.
Exceeding 50,000, and not exceeding 100,000 gallons -	4s. 6d.	„	
„ 100,000, „ 200,000 gallons -	4s. 3d.	„	
„ 200,000, „ 400,000 gallons -	4s. od.	„	

Meters to be provided at the expense of the consumers :—

Not exceeding 50,000 gallons per quarter -	-	-	3s. 9d. per 1,000 gallons.
Exceeding 50,000, and not exceeding 100,000 gallons -	3s. 6d.	„	
„ 100,000, „ 200,000 gallons -	3s. 3d.	„	
„ 200,000, „ 400,000 gallons -	3s. od.	„	

High-pressure engines, £6 per horse-power.

An immense quantity of water could be profitably used for mining purposes in the Sandhurst District, if it were available ; but it should not be supposed that the prices now charged would be maintained if water were plentiful.

To meet the wants of the miners, and to enable them to get gold from the auriferous earths with some reasonable prospect of profit, it is indispensable that water shall be available at a small price. In the richer gullies it might repay the miner to wash the dirt under some disadvantages as to quantity and price ; but in dealing with alluviums which have been turned over many times, he could not afford to pay more than a few pence per 1,000 gallons, and he would require an abundant supply.

In many parts of the Mining District of Maryborough, and on the goldfields between Talbot and Avoca, it is probable that hydraulic hoses will be used in all those places where the fall of the surface of the land and the shallowness of the alluviums admit of excavations being made at small cost, and in such a way as to provide for drainage over the surface of the alluviums in the lower parts of the valleys.

In the flats it will undoubtedly be necessary to raise the auriferous gravel to the surface, because the levels of the bed-rock do not admit of the escape of the waste water by natural drainage.

In the Beechworth District, and in many parts of Gippsland, the hydraulic hose can be used effectively ; and reservoirs in these districts will be productive of great benefits to the miner.

The prices paid by the miners for water on the several goldfields vary. The price depends partly on the quantities supplied, partly on the quality of the water, whether clear or muddy, and in some degree on the competition which arises where a patch of rich ground is commanded by only one or two sluices.

In the Beechworth district, Mr. Walter Butler, the warden, estimates the average price at 25s. per week for a sluice-head (for seventy-two hours).*

* What is a "sluice-head" has long been a subject of controversy. As showing the results of the efforts made by the several Mining Boards in the colony to arrive at something like a uniform measure, I have obtained from Mr. Clement Johnstone, one of the professional officers of the Mining Department, a statement of the number of gallons per twenty-four hours, which would be delivered under the conditions severally set forth in the bye-laws of the seven Mining Boards. They are as follows:—

SIZES OF SLUICE-HEADS IN THE SEVERAL MINING DISTRICTS.

District.	Division.	Sluice-boxes.				Number of gallons per twenty-four hours.
		Length.	Width.	Depth inside.	Opening across bottom.	
BALLAARAT (a)	All divisions	—	16 ins.	1 in.	—	211,500
BEECHWORTH (b)	All divisions	12 feet	12 ins.	6 ins.	1½ in.	178,500
	except					
	Buckland	12 feet	12 ins.	6 ins.	3 ins.	476,000
	Goulburn					
	Mitta-Mitta					
	Woolshed					
	Yackandandah (for bank water-rights)	12 feet	12 ins.	3½ ins.	3 ins.	363,500
	Yackandandah (for creek water-rights)	12 feet	12 ins.	7½ ins.	7 ins.	1,240,500
SANDHURST (c)	All divisions	6 feet	12 ins.	6 ins.	3 ins.	476,000
MARYBOROUGH (d)	All divisions	12 feet	20 ins.	3 ins.	—	1,875,500
CASTLEMAINE (e)	All divisions	6 feet	10 ins.	3½ ins.	2 ins.	202,000
ARARAT (f)	All divisions	6 feet	12 ins.	3½ ins.	—	2,342,000
GIPPSLAND (g)	All divisions	—	16 ins.	1 in.	—	211,500
	except					
	Kobana East	—	16 ins.	2½ ins.	—	476,000
	Tarraville					

(a.) Pressure not to exceed six inches.

(b.) In races carrying more than one head of water, the box shall be increased in width twelve inches for each additional head.

(c.) In races running more than one sluice-head of water, the box shall be increased in width twelve inches for each additional head.

(d.) Fall of half-inch to the foot on length of box.

(e.) When the race exceeds a mile in length, the width of the box may be increased half-an-inch for each mile.

(f.) Fall or inclination of box to be one foot in the entire length of it.

(g.) Pressure not to exceed six inches.

a, b, c, e, g. Rule.—Multiply the square root of the height by eight for the natural, and by five for the effective velocity; and the product will be the velocities required [in feet per second].—*Dwyer on Engineering*, p. 77.

d, f. Rule.—Multiply the area of the transverse section by twice the fall per mile, and divide the product by the border, or twice the depth added to the bottom breadth, and the square root of the quotient multiplied by fifty-five times the sectional area will be the discharge in cubic feet per minute.—*Dwyer on Engineering*, p. 39.

The following table, compiled by Mr. Butler, shows the prices paid by the miners in the vicinity of Beechworth :—

STATEMENT AS TO SALE OF WATER FOR MINING PURPOSES, FROM MINER TO MINER, ETC.,
IN THE VICINITY OF BEECHWORTH.

Seller.	If holder of Water-right, No.	Buyer.	Rate.	Quantity or terms of usage.	Nature of Water.	Remarks.
McLeod and Molesworth	93 and 95	Chinese -	£3 10s. per week	Under two sluice-heads in summer and about three sluice-heads in winter	Clear water, constantly running. Stored by Chinese in dam	The sellers could obtain a higher price, but would not be so secure as to permanency of agreement.
Smith and Hobart	189	Chinese -	£1 per week	Surplus of their tail-water after one head is taken by other parties	Moderately clear, but at times very muddy.	
Collins and Co.	Application No. 60	Europeans	£30 per annum	All tail-water available	Muddy - - -	The original sale was for £60 per annum, but the lesser amount had to be accepted.
J. Hendry and Co.	36	Europeans	10s. per week	All tail-water available	Spring water muddy from use	Muddy water is not worth within 10s. per sluice-head of clear water.
Shand and Co.	126	Europeans	£60 per annum	All tail-water available	Spring water muddy from use	
Saml. Norton	Application No. 38	Chinese -	20s. and 30s. per week, 5s. per day	Sufficient water to work claim, but over one sluice-head	Springs - - -	Has made absolute sale of all his tail-water to Chinese about to work on Buckland road, Two-mile, for £5 per week.
Beechworth Municipal Water Works Company	Private Act, 24 Vict., No. 105	Europeans	25s. per week	Sluice-head as defined in their Act, 24 Vict., No. 105, clause 16*	No water at present available.	
Ovens Water Works Co., Stanley	—	Collins and Co., Two-mile	£3 per week	Taken direct from reservoir, and conveyed to Two-mile Creek. Clear water	Stored in reservoir	All available water. No gauge. Quantity varies from two to five sluice-heads.

* According to the conditions named in this clause—an orifice twelve inches long, by one and one-eighth inch in height, and with a constant head of five inches—the quantity of water passing through would be as follows :—

In one hour - - -	6,780 gallons.
In twelve hours - - -	81,360 "
In twenty-four hours - - -	162,720 "
In eighty-four hours - - -	569,520 " which, at £4 per week, would be 1d. per 593 gallons.

According to information furnished by Mr. Alfred Wills, the warden at Buckland, it appears that the Buckland miners, using hydraulic hoses, or washing the ground from the surface of the rock, rent what are called "Ground sluice-heads," and use all the water they can get. The quantities average from 80 inches to 150 inches, and the miners pay from £2 to £3 per week. The water is gauged generally in accordance with the Beechworth Bye-laws, and the smallest quantity of water used at Buckland is equal to two of the sluice-heads allowed by the bye-laws.

"Letting" water is not very common now at Buckland. The race-holders prefer to supply water, furnish pumps, wheels, &c., and become partners in the claims, on the condition that they shall get one-fourth of the gold after the working expenses are paid.

A "wheel-head" or "motive-power right" varies from fifty to eighty inches, and the rent is usually from 30s. to 40s. per week. These are summer prices. Rains generally fall about the end of May, and the rents then fall 25 per cent.*

Though these prices are common enough, it is far from certain that, if a plentiful supply of water were available, they would be maintained.

A great number of water-right licenses issued for the Beechworth District were absolutely rejected, because the rents fixed by the Government—from £15 to £95 per annum, for very large quantities of water—were deemed too high.†

In one case, where a licensee proposed to divert 36,000,000 gallons per diem, he objected to accept the license, because the rent was fixed at £50 per annum: so much depends on the situation, the uses to which the water is to be applied, the quantity available, and the competition.

At Clunes, where a supply of water is urgently required, and where, if anywhere, it would command a high price, it is estimated that a sum of £30,000 would be sufficient for the erection of necessary works, and that 16½ per cent. would at least be realized.

It is computed that for the uses of the several mining companies, and for domestic and other purposes, 6,000,000 gallons per diem are required, and that a price, little exceeding on the average one penny per 1,000 gallons, would give an annual revenue of £7,972 9s. 4d.

Large works are now in course of construction for the supply of water to the goldfields of Castlemaine and Sandhurst and the town of Geelong, and schemes have been devised for other districts which would necessitate an expenditure in the aggregate of probably £2,000,000. That they would be beneficial, and either directly or indirectly well repay the cost of construction, there is little doubt; but, unless wisely designed, and so made as to need only small annual charges for maintenance, they would be rather a burden on the country than a source of revenue.

There is a general belief that water would be used largely by agriculturists if it were available; and though it is not becoming in one who has had no practical

* A. C. Wills, Esq., warden, Buckland.

† Licenses for diverting the quantities of water undermentioned in the Beechworth District were not accepted by the applicants, because the amount of rent per annum set opposite the quantities was deemed too high:—

						£	s.	d.
112.	-	-	-	9,676,800 gallons per diem	-	-	-	95 0 0
158.	-	-	-	3,500,000 "	-	-	-	35 0 0
160.	-	-	-	2,000,000 "	-	-	-	20 0 0
200.	-	-	-	1,382,400 "	-	-	-	15 0 0
201.	-	-	-	2,916,000 "	-	-	-	30 0 0

In other words, the applicants could not afford to pay at the rate of 0·007d. per 1,000 gallons for it.

These facts seem to show that much care needs to be exercised in estimating the revenues likely to be derived from artificial supplies of water. It is probable that well devised schemes will prove remunerative; but, unless the principles which guided the Committee of the Board of Science are adhered to—namely, the selection of only such sites as admit of a frequent renewal of the water which the reservoir is estimated to contain—say not less than, under unfavorable circumstances, thrice in the year; and only such reservoirs as will be available without expensive works for the conveying of the water—they will not serve the purposes of the miner. The nearer the reservoir can be constructed to the place where the water is to be used, the better will be the results, both directly and indirectly.

'experience in irrigating tracts of land to offer any decided opinion, it is yet fair to enquire whether, having regard to the prices of labor in this country at present, any extensive works for irrigating even grass lands could be undertaken with reasonable prospects of profit. Drainage and irrigation go together. A free supply of water is actually prejudicial unless means be adopted for getting rid of it quickly. Any one who has used water even on a small scale is aware how certainly it destroys vegetation if allowed to stagnate. And in considering the prospects of an agriculturist who would have the spirit, energy, and skill to undertake and carry to completion a scheme of irrigation for say 500 acres of land, we should endeavor to estimate the first outlay in the formation of the surface, the construction of channels, and the maintenance of these in an effective condition, as well as the uses to which such land could be put if efficiently irrigated, and the competition to which the occupier would necessarily be subjected. The vast inland tracts yield herbage plentifully; and the cattle and sheep of the settler can roam over miles of country without necessitating more expense than the wages of a few shepherds and stockmen, and the annual license fee; and the stock can be brought to market generally in fair condition. Perhaps gardens, orchards, and some small tracts near the metropolis, might be irrigated profitably; but it is, to say the least, doubtful whether water would be used largely anywhere, even if it were available at a cheap rate, so long as the cost of labor is so great. The stock-owner who would feed and fatten his sheep and cattle on irrigated lands would have to compete with settlers who have incurred but slight costs in making their runs available for stock.

Until there arises amongst us some colonial Mechi to conduct experiments, the questions connected with irrigation will not be settled. They are too difficult to be decided hastily; and too momentous to be dismissed without enquiry.*

* The following observations from the pen of one of the most thoughtful and accomplished men in the world of science are inserted here, in order that proper consideration may be given to this question, and that it may be approached with calmness and seriousness :—

"It belongs rather to agriculture than to geography to discuss the quality of the crops obtained by irrigation, or the permanent effects produced by it on the productiveness of the soil. There is no doubt, however, that all crops which can be raised without watering are superior in flavor and in nutritive power to those grown by the aid of irrigation. Garden vegetables, particularly, profusely watered are so insipid as to be hardly eatable. Wherever irrigation is practised there is an almost irresistible tendency, especially among ignorant cultivators, to carry it to excess; and in Piedmont and Lombardy, if the supply of water is abundant, it is so liberally applied as sometimes not only to injure the quality of the product, but to drown the plants and diminish the actual weight of the crop. * * * * * The practice of irrigation, except in mountainous countries where springs and rivulets are numerous, is attended with very serious economical, social, and political evils. The construction of canals and their immensely ramified branches, and the grading and scarping of the ground to be watered, are always expensive operations, and they very often require an amount of capital which can be commanded only by the state, by moneyed corporations, or by very wealthy proprietors; the capacity of the canals must be calculated with reference to the area intended to be irrigated, and when they and their branches are once constructed it is very difficult to extend them, or to accommodate any of their original arrangements to changes in the condition of the soil, or in the modes or objects of cultivation; the flow of the water being limited by the abundance of the source or the capacity of the canals, the individual proprietor cannot be allowed to withdraw water at will, according to his own private interest or convenience, but both the time and the quantity of supply must be regulated by a general system applicable as far as may be to the whole area irrigated by the same canal, and every cultivator must conform his industry to a plan which may be quite at variance with his special objects or with his views of good husbandry. The clashing interests and the jealousies of proprietors depending on the

Statistics of other countries are easily obtained, but it is probable that no person in this colony could say with any approximation to truth what would be the cost of preparing and irrigating a tract of 500 acres, and what would be the increase if water were supplied plentifully.

In the same spirit we should enquire whether water will be used largely for sluicing and hydraulic mining. That it will be used abundantly on our goldfields and largely increase the yield of gold is certain; but it is pretty generally admitted by practical men that, as a rule, it will be employed most beneficially in the quartz mills. Unless the fall be sufficient it cannot be used effectively in hydraulic mining; and our stiff clays, which when treated with water form into hard round balls, will not be easily reduced by ordinary methods. But a plentiful supply of water for the goldfields is an absolute necessity if we are to continue rich and prosperous, and once available the skill of the miner will soon be employed in such a way as to make a profitable use of it.

Construct a reservoir where you will in this country it cannot fail to be a source of wealth, and in supplementing the work of Nature we are merely discharging a duty. With the best possible sites available, the freest choice in the selection of them, having nothing to pay for the land on which the works are to be constructed, and with the plainest indications as to the localities most in need of water and where it would be most eagerly purchased, there is an absolute certainty that even an almost extravagant outlay would in the end prove beneficial and add to the prosperity of the country.

same means of supply, are a source of incessant contention and litigation, and the caprices or partialities of the officers who control, or of contractors who farm the canals, lead not unfrequently to ruinous injustice toward individual landowners. These circumstances discourage the division of the soil into small properties; and there is a constant tendency to the accumulation of large estates of irrigated land in the hands of great capitalists, and consequently to the dispossession of the small cultivators, who pass from the condition of owners of the land to that of hireling tillers. The farmers are no longer yeomen, but peasants. Having no interest in the soil which composes their country, they are virtually expatriated; and the middle class, which ought to constitute the real physical and moral strength of the land, ceases to exist as a rural estate, and is found only among the professional, the mercantile, and the industrial population of the cities."—*Man and Nature*, by George P. Marsh, p. 378-9.

On the other hand, we have to consider the great increase in the yields which follow on a well managed system of irrigation; and we have to set against certain obvious disadvantages numerous benefits. The profits arising from a judicious use of water are considerable. (See Captain Baird Smith's *Italian Irrigation*, p. 80-99, vol. II.)

The weather-wise Egyptians say that "countries which rely on nothing but rain-water will one day be disappointed of their grand hope, and be wretchedly hungry," and in our dry climate a prolonged drought would make us hungry indeed.



Metals other than Gold, Metalliferous Minerals, Coal and Lignite, Clays, Slates, and Miscellaneous Minerals.

OSMIRIDIUM.

Osmiridium (iridosmine), and other metals belonging to the platinum group, are supposed to be of rare occurrence in the colony. Platinum, it is believed, has not been found in Australia, but it occurs in New Zealand. Mr. George Foord has found scales of osmiridium embedded in the upper surfaces of the small bars of gold which have been obtained from the slags remaining after a day's smelting. He is not able to name the localities where the alloy occurs, because he has got it only after smelting large parcels of gold from various parts of the colony.

Long before platinum was discovered in New Zealand, or, at any rate, before the metal was known and recognised there, Mr. Foord had suggested—in a letter to the *Argus*, dated the 20th November, 1857—that it would probably be found in the gold drifts of those islands; and he was the first to detect osmiridium in the gold obtained in the colonies. Now platinum is often collected in considerable quantities by the miners at Hokitika and elsewhere.

Exaggerated statements of the value of platinum are given from time to time. It may be of some interest to state that the metal, as it is found in New Zealand, is, according to the information furnished by Mr. Foord, worth no more than 6s. 6d. or 7s. 6d. per oz.

Having regard to the ordinary modes of occurrence of these ores, we might suggest that the most likely localities in this colony for metals belonging to the platinum group—platinum, osmium, iridium, rhodium, ruthenium, palladium—are the creek beds near Berwick, Daylesford, Wood's Point, the heads of the Werribee, the *gutters* of the leads at *Eldorado*, and the alluviums of Tubba-Rubba Creek in the county of Mornington.

SILVER.

NATIVE SILVER.

Native silver occurs with native copper in the quartz lodes at St. Arnaud. It appears as small specks in the lode-stone and in filaments with arseniate of lead. Gold and silver alloy is found at Reedy Creek, near Kilmore, in the reefs at Sandhurst, and at St. Arnaud. Only small quantities have as yet been brought to Melbourne.

ORES OF SILVER.

Argentiferous galena and chloro-bromide of silver (first discovered in the colony by Mr. George Foord) are found at St. Arnaud with iron pyrites, the sulphide and carbonates of copper, native copper, native silver, gold, carbonate of lead, sulphate of lead, arseniate of lead, arseniate of iron, zinc-blende, native sulphur, brown iron ore, and the ores of manganese.

It is associated also with antimony-glance, where the proportion is in some specimens 80 ozs. of silver per ton.

Sulphide of silver (*silver-glance*) is got in the reefs at Morse's Creek, and in other reefs where argentiferous galena has decomposed.

Fine specimens of the embolite which occurs at St. Arnaud were exhibited by the Mining Department at the Intercolonial Exhibition (*en rapport* with the Paris Exhibition, 1867). The crystals (cubic) were attached to stalactitic brown iron ore, and were of an olive green color, and malleable. The hardness was about 2.0.

The composition of the St. Arnaud embolite, according to an analysis made by the late Mr. Charles Wood, is as follows :—

Silver	-	-	-	-	-	-	-	-	-	65.14
Bromine	-	-	-	-	-	-	-	-	-	24.16
Chlorine	-	-	-	-	-	-	-	-	-	10.73
										100.03

This ore is found above the *water-level* in the St. Arnaud reefs, in cavities—in *mice-eaten* quartz, and considering the nature of the minerals with which it is associated, there is little doubt that it has been derived from the decomposition of galena and other mineral deposits.

Below the water-level the miners find sulphides; and it is probable that large quantities of argentiferous galena will be got from these reefs, as well as auriferous pyrites and free gold.

Lately some samples, consisting of massive quartz and what seemed to be tailings from a crushing machine, forwarded to the Office of Mines by one of the local officers, were examined and reported on by Mr. Cosmo Newbery. The massive samples gave 93 ozs. 13 dwts. 12 grs. of silver, and 4 ozs. 3 dwts. of gold per ton; and those from the tailings 39 ozs. 14 dwts. 10 grs. of silver per ton. The gold in the last was not estimated. Mr. Newbery states that he separated the pyrites and sulphurets from the quartz; and that therefore, to arrive at the proportions of silver and gold in the lode-stone, the results should be divided by five.

At St. Arnaud, Ararat, Pleasant Creek, Morse's Creek, Sandhurst, Heathcote, Anderson's Creek, Donovan's Creek, Sunbury, and Reedy Creek near Kilmore, there is silver to be obtained; and some strong efforts will by-and-by be made to separate it and bring it to market in quantities sufficient to establish Victoria as a silver-producing country.

According to returns made to the Department of Mines, the following quantities of silver ores and silver have been raised (mostly at St. Arnaud) :—

	Silver Ores.		Silver.	
	Tons.		Ozs.	dwts.
Previously—up to 31st December, 1866	8,019	-	12,513	6
From 1st January to 31st December, 1867	178	-	78	12
Totals	8,197	-	12,591	18

The following statement of exports has been received from the Department of Trade and Customs:—

Year.	Silver Ores.		Silver.	
	Tons	cwt.	Ozs.	dwt.
1861 - - - - -	10	6	—	—
1864 - - - - -	—	—	4,207	15
1865 - - - - -	—	—	4,954	0
1867 - - - - -	—	—	366	2
Totals - - - - -	10	6	9,527	17

During the current year (1868) there have been exported 5,604 ozs. 9 dwts., of the estimated value of £1,401.

TIN.

Up to the present time there have not been discovered any veins or rock masses carrying crystals of oxyd of tin; but from the manner in which this mineral usually occurs, it is easy to conceive that many veins may have been cut by the miner without his perceiving that they were stanniferous. It is indeed not easy for an inexperienced person to detect crystals of oxyd of tin in place.

Cassiterite was first recognised, amongst the black sands brought from the gold-fields, by Mr. George Foord, on the 11th March, 1853.

Stream tin is found in the Beechworth District, in the tributaries of the Lerderderg, at Gympie near Steiglitz, in the tributaries of the River Yarra, in the basin of the River Thomson, and in many of the feeders of the River Latrobe. It occurs also in the Strathbogie Ranges and in the Belltopper *Lead* at Taradale. The color of the crystals is usually black, but some are hyacinth and dark-red, and others light-yellow and brown. They are easily overlooked when in fragments and mixed with zircons, pleonaste, and dark sapphires.

The pure ore from the Woolshed Creek, Beechworth, contains 78 per cent. of tin and 22 per cent. of oxygen. As usually sent to market it is mixed with titaniferous iron, schorl, &c., and gives about 53 per cent. of tin.

In August, 1866, Mrs. Janette Bowman forwarded to the Mining Department a sample of black sand and tin ore from a creek near Berwick, and from an examination made by the Government Analyst, it contained, when separated from the schorl and titaniferous iron sand with which it was mixed, about 42 per cent. of tin, and a considerable proportion of gold.

Subsequently another parcel, procured from the same locality, and forwarded for examination by Mr. M. L. King, M.L.A., was examined by Mr. Newbery, and he reported that the sample consisted of a mixture of fine and coarse black sand, a little quartz sand, and a few specks of gold, the whole quantity weighing 2,087 grains. Though the sample contained a considerable quantity of tin ore, it could not be profitably smelted unless it were first passed through a "jigging machine" to separate the fine from the coarse portions, and then washed so as to remove the iron sand, which is present in quantity.

The sand was passed through a series of sieves, which divided it into five portions.

No. 1 contained about 60 per cent. of tin ore, yielding between 50 and 60 per cent. of metallic tin. This was caught in a sieve with 256 meshes in an inch, and weighed 280 grains.

No. 2 caught in a sieve with 324 meshes, weighed 189 grains ; it contained some tin, but would require concentrating before smelting.

Nos. 3, 4, and 5, weighing 740, 553, and 325 grains, contained so little tin that they could not be profitably worked.

So that the whole sample did not contain much more than from 8 to 10 per cent. of metallic tin, the remainder being chiefly titaniferous iron ore.

The wide distribution of this ore ; the mode in which it occurs, both in the deep leads and in the shallow alluviums in the district of Beechworth ; the ease with which it can be collected and prepared for market, and the high price it brings, all serve to show the necessity for proper care, more research and more diligence on the part of the miner. It is probable that in a short time we shall discover the sources of the great quantities of stream tin which fill the beds of the *leads* in the western part of the Beechworth Goldfield, and be enabled to extract the ore from the veins. The discovery of a vein would be of high importance, and would add greatly to the mineral produce of the colony ; and assist also in the development of other stanniferous districts, by rendering familiar to the miner the aspect of tin-bearing rocks.*

The following statement of exports is taken from returns furnished by the Honorable the Commissioner of Trade and Customs :—

TIN ORE.		Tons	cwt.
Previously—up to 31st December, 1866, black sand and tin ore		2,473	4
From 1st January to 31st December, 1867 -	- - -	177	10
Total	- - -	2,650	14

TIN.		Lbs.
Previously—up to 31st December, 1866	- - -	8,160
From 1st January to 31st December, 1867 -	- - -	4,256
Total	- - -	12,416

During the current year (1868) the exports have been as follows :—

	Tons.	cwt.
Black sand	220	7
Tin	5	18

COPPER:

Native copper is found in the veins at St. Arnaud with gold, native silver, and the ores of copper and silver ; in the copper mines on the River Thomson, in Gippsland, both in the vein and as water-worn pieces in the bed of the river ; in the reefs at Castlemaine, Steiglitz, Crooked River, &c. ; and from the Deep *Lead*, at Avoca, a small flattened nugget, with particles of gold attached to it, was taken, together with many small pieces of native lead.

Fine crystallized specimens, having filiform and arborescent shapes, have been got at Wilson's Reef, St. Arnaud.

* In order that the miners at Beechworth might have an opportunity of inspecting the vein-stones in which crystals of tin occur, I forwarded a number of specimens procured from the mines of Cornwall to the local museum. I was indebted to Mr. R. H. Bland for these, who at all times has shown an earnest desire to aid in the development of the mineral resources of the colony.

Green and blue carbonates of copper are found in small quantities in the quartz veins at Steiglitz, Castlemaine, Smythesdale, Blackwood, St. Arnaud, Landsborough, Dunolly, &c. ; and copper stains and very small crystals of green carbonate of copper have been observed in the upper palæozoic rocks at Mansfield, and near the Pentland Hills.

The red oxyd, black oxyd, copper pyrites, indigo copper, arseniate of copper, sulphate of copper, and other ores, occur in many of the localities above-named ; but the only vein from which large quantities of copper have been got is that on the River Thomson.

The diorite dykes in which the copper pyrites is found are situate on the Thomson, about five miles south of the junction of that stream with Stringer's Creek.

In some places, it is said, the vein or mass of copper ore is more than thirty feet in thickness. From information furnished by Mr. W. H. Foster, the warden at Sale, and Mr. Arthur Everett, one of the officers of the Mining Department, it would appear that there is a considerable quantity of ore in this locality ; and that a fair prospect presents itself to the miner.

The chief mining surveyor has not yet had an opportunity of inspecting the mine, and I am unable to give a description of the country or state more exactly than I have done how the ore occurs. It is to be hoped that a scientific examination of this district will be made at no distant date.

The mining manager forwarded, at Mr. Everett's request, the following report on the mine. It is dated 29th October, 1867 :—

"The ground upon which the mine is situated comprises an area of 640 acres. Adjoining this on the northern boundary, and along the course of the lode, a separate lease of 390 acres has been granted to the present company.

"The character of the country is mountainous, and the situation of the lode where ore is now being broken possesses an altitude of 330 feet to the Thomson River, which runs at a horizontal distance westward of 420 feet, thus affording excellent facilities for future tunnelling operations.

"The size of the lode is not yet proved. Thirty feet in width has, however, been discovered without striking the hanging wall. The lode is composed of ferruginous quartz, oxyd and sulphuret of iron, and sulphuret, carbonates, and oxydes of copper. In general appearances the lode bears resemblance to those of the mines of Devon and Cornwall.

"The bearing of the lode as at present ascertained is N. 15° W., with an underlie east of not less than an angle of 20°.

"The work done up to the present time consists of an upper tunnel, driven in a southerly direction in the body of the lode a distance of 140 feet, from the floor of which a shaft has also been sunk to a depth of forty feet vertically without cutting the foot-wall, thus showing that the lode maintains its strength in depth.

"To cut the lode at a lower depth of 130 feet perpendicularly, a crosscut tunnel has been driven 220 feet, which will, however, require to be driven further to intersect it. Prospecting works have also been carried on northward of the present workings, and discoveries thereby made prove beyond doubt the continuance of the lode.

"Stopping or breaking of ore from the roof of the upper tunnel has been carried on to a small extent ; the amount of ore obtained by this means, together with the ore out of the forty-feet shaft and the driving of tunnel, is from 300 to 350 tons, which has been dressed or assorted preparatory to the smelting of the same.

"Two reverberatory furnaces have been erected on the western side of the river, which works are connected with the mine by means of tramways and shoots. Fifty tons of ore have been smelted, yielding 214 cwt. of regulus, worth from forty to fifty per cent.

"When the two furnaces mentioned are in operation, from fifty-five to sixty tons of regulus, of fifty per cent., will be realized monthly. It is, however, intended to reduce the ores to a higher per centage, viz.—rough copper of ninety per cent., and afterwards to refine the same upon the ground.

"For fuel wood is used, there being an abundance in the immediate locality, which by means of tramways can be cheaply conveyed to the works.

"A limestone formation, and also clay for common bricks, exist in the immediate neighborhood of the smelting works, which are of great advantage."

According to the returns received, the following quantities of copper ore have been raised:—

	Tons.
Previously—up to 31st December, 1866 - - - -	350
From 1st January to 31st December, 1867 - - - -	230
Total - - - -	580

The manager of the Gippsland Copper Mining Company, Thomson River, reports 274 tons smelted up to 31st December, 1867, producing forty-one and a-half tons of regulus, of an average of fifty per cent.; thirty-three tons of which were sold and realized net £932 10s. 2d., and eight and a-half tons were converted into rough copper of ninety per cent., valued at about £230.

The following statement of exports has been received from the Customs Department:—

	Tons cwt.
Previously—up to 31st December, 1866 - - - -	31 4
From 1st January to 31st December, 1867 - - - -	0 3
Total - - - -	31 7

The quantities exported during 1868 are as follows:—

	Tons cwt.
Copper ore - - - - -	24 6
Copper - - - - -	17 12

ANTIMONY.

Sulphide and oxyd of antimony and valentinite, with free gold, are found at Heathcote, Whroo, Templestowe, Caledonia, Anderson's Creek, and Donovan's Creek, in the basin of the River Yarra, Rutherglen, Maryborough, Blackwood, Wood's Point, Maldon, Daylesford, Ballaarat, &c. At Whroo very remarkable concretions are found in the veins. Concentric layers of variously colored oxydes surround a central nucleus of sulphide, and all through the oxyd occur ragged pieces of gold varying in size from a mere speck to pieces as large as a lupin seed.

What is reported to be a very large vein has lately been found at Munster Gully, Dunolly. Over the surface of the ground for a considerable distance are scattered fragments of oxyd and sulphide of antimony, and it would appear that the vein is of unusual extent.

At Donovan's Creek, on the Upper Yarra, a vein varying from eighteen inches to two feet in thickness, and filled with bright, clean, nearly pure sulphide, has lately been opened; but the expenses attending the transport of the ore will probably prevent its being brought to market for some time at least.

It has been said that washed pieces of sulphide of antimony have repeatedly been found in the deep *leads* of Ballaarat. This I believe to be a mistake. It probably arose from the publication of my report on a mineral found in the Koh-i-noor claim at Ballaarat, and sent to me by Mr. R. M. Serjeant. The specimens were covered on the outside with partially decomposed sulphide of antimony, and they contained a little lead. Rolled fragments of sulphide of antimony are probably of very rare occurrence in alluvial deposits; and it is not easy to say how the sulphide could be conserved for any length of time in layers permeated by water. The specimens found by Mr. Serjeant were probably got from the tenacious black clay of the *lead*.

Having heard that a vein of sulphide of antimony with gold had been opened at Sunbury, the subject was mentioned to the Honorable the Minister of Mines, and he requested the chief mining surveyor to visit the spot and examine it. From the report which he made it appears that "The quartz vein is situated on allotment 25, parish of Bulla, about a mile and three-quarters north-east of the Digger's Rest Railway Station, near the summit of a ridge on the eastern bank of the Saltwater River, and on a patch of the silurian formation, which lies exposed at that place. A shaft has been sunk from which quartz has been mined from the surface downwards; and there is a shaft seventy feet deep, with drives about fifteen feet southward and sixty feet northward from the bottom thereof, following the strike of the vein in each instance.

"The mineral consists chiefly of quartz and sulphide of antimony, and the vein has an irregular course along the strike of the silurian strata, crossing them in some places diagonally. It appears to vary in thickness from one foot six inches down to three inches, so far as it has yet been traced. In the deep shaft it is found to underlie to the eastward from the surface to a depth of forty-seven feet, from thence to seventy feet it is vertical, and to a further depth of nine feet it underlies to the westward, somewhat in conformity to the dip of the silurian strata.

"About twenty chains southward from the shafts, on the bank of the river, Mr. Beattie has erected an eight horse-power portable engine, with a set of four rotatory stamps, capable of crushing five tons of mineral in twenty-four hours.

"The results of crushings up to the present time are said to be as follows:—

"September, 1866, 37½ tons yielded 80 ounces of gold,

"August 10, 1867, 120 " 228 "

being an average of two ounces to the ton.

"From the irregular strike and thickness of the vein so far as it has yet been worked, it cannot be described as a well-defined reef; but the discovery appears to be of importance as indicating the probable existence of auriferous reefs underlying the extensive basaltic plains between Melbourne and the Great Dividing Range, and a close examination of the silurian formation exposed in places along the principal water-courses may lead to other valuable discoveries."

The discovery of an auriferous vein of antimony by a miner in a locality only seventeen miles from Melbourne, which has been surveyed and re-surveyed without yielding any hint as to the existence of either gold or antimony, is surely sufficient to show that we must not despair of the resources of any part of the colony merely

because the published maps are devoid of information which the miner has so long been seeking for in vain.

The antimony mines of Costerfield were discovered many years ago, and they have been wrought with varying success up to the present time. A good deal of gold is got in all the veins where the antimony is found.

The economic importance of the minerals which occur in this tract of country seemed to me to require that some examination of them should be made by an officer of the Government; and as far back as 1863, and often subsequently, I suggested that the work should be commenced; but it was not until Capt. Couchman was appointed to the office he now holds that any clear account of these valuable mines was obtainable.

He visited them in September, 1867, and the following extracts are taken from his official report:—

“At the time of my visit only three mines were being worked on the antimony reefs, the principal one of these is held by the Costerfield Company, and is situated at Upper Costerfield, about six miles in a direct line north of east from Heathcote, the other two are at Lower Costerfield, about one mile southerly from the last named. I think it very likely that these mines are on the same line of reef, as the bearings along the strike of the reef at each place appear to be identical, and to lead from one to the other very nearly.

“The lode now being worked shows surface indications in the Upper Costerfield mine, but from thence it dips along the strike southerly, and all traces of it disappear from the surface until it (or another vein) shows itself at Lower Costerfield.

“The Costerfield Company have erected on their ground valuable machinery and plant, consisting of an engine of fifty horse-power for crushing and pumping; an engine of twelve horse-power for winding; a battery of twelve heads of stamps; a smelting and reverberatory furnace and oxyd flue; a Cornish buddle, &c.

“The ore in this mine consists of sulphuret seamed with brown and white oxyd of antimony, combined with a small proportion of auriferous quartz; but below the natural water-level there are no traces of oxyd to be found.

“The vein bears along the strike N. 25° $30'$ W., and varies in thickness from one to ten feet from the surface at the main shaft of the Costerfield Company to a depth of 180 feet, with an underlie to the east, forming an angle of 80° with the horizon. From this point to a depth of 280 feet to the lowest level, the schist rock, in which the vein occurs, changes from a soft to a hard blue crystalline shale, and the vein decreases to a regular thickness of from eight to twelve inches, with a much greater underlie, dipping to the east at an angle of 56° with the horizon; the harder schist rock in the lower levels of the mine appears to form a kind of band, dipping from north to south along the strike of the vein, and in every portion of the mine where it occurs the latter abruptly decreases to the minimum thickness. It is, however, expected that this harder rock will not prevail to any great depth, and that beneath it the lode will again expand to its ordinary size, an opinion I think likely to be correct, as similar variations in the thickness of quartz veins, apparently the result of a change in the character of the schist rock walls, have been found in other mines on the goldfields.

“Large quantities of ore have been raised by the Costerfield Company, and nearly the whole of their crushed antimony (tailings) is now heaped on the surface.

“The Company at the present time are treating their ore in the following manner. That portion of it free from quartz is picked out and set aside for smelting, the remainder being crushed to extract the gold.

"The tailings, which consist of antimony and a little quartz sand, are then conveyed to the heaps, and are subsequently prepared for smelting by a process of buddling, as follows. A sluice-box, into which a stream of water is turned, is fed with tailings, which are made to pass thence on to a triangular tray forming an inclined plane, so arranged as to cause the water and tailings to flow over it in a broad shallow stream, into an oblong receiving pit below; the purest antimony ore, from its greater specific gravity, settles in the pit at the end nearest the tray; as the sediment recedes from this end, it gradually becomes mixed with an increasing proportion of sand, but much of the latter is carried away in the overflow of water from the pit.

"On clearing out the receiving pit, that portion of its contents containing quartz sand is returned to the heaps, to be again passed through the buddle, and the pure ore is collected in bags, and sent to the boiler-house to be dried; it is then placed in the smelting furnace, with equal proportions of uncrushed ore, and reduced to crude antimony (sulphuret), the slag and cinder resulting from this process being further treated by roasting or calcining in the reverberatory furnace, to free the oxyd, which passes off in the fume from both furnaces into the oxyd flue, and as the fume cools on its passage to the smoke stack the oxyd is deposited in chambers constructed in the flue to receive it.

"The residue from the reverberatory furnace is afterwards crushed to extract any gold it may contain.

"The process of smelting the antimony ore has only been lately commenced by the Costerfield Company. I am informed by the manager that the gold obtained from the mineral they are now raising defrays the whole of the company's working expenses, and that the yield of crude antimony and oxyd is clear profit; none of the latter has yet been brought into the market, but the shipments of rough ore hitherto sent to England have realized from £9 to £12 per ton. The ore yields about forty-five per cent. of crude antimony, which it is expected will fetch from £20 to £22 per ton in London; thus, by reducing it from the rough to the crude state, a considerable saving would be effected in carriage and freight.

"The lease block of the Minerva Company is situated immediately south of the Costerfield Company's ground, but no mining operations have been carried on there for some time. The engine-house is still standing, and the main shaft has been sunk to a depth of 180 feet, but owing to the expensive nature of the workings the vein was not found to pay. I believe the Costerfield Company are now in treaty for the purchase of this property.

"Of the two claims now in operation at Lower Costerfield, the principal one, belonging to Mr. Morris, has been partially worked to a depth of (200) two hundred feet; at the present time it is let on tribute, and the workings do not extend below the water-level, a depth of sixty-five feet, as there is now no machinery on the ground for pumping. The reef at this place is not so rich in antimony as at the Upper Costerfield mine, but it is highly auriferous; it has varied from two to nine inches in thickness, and has hitherto produced from 5 ozs. to 12 ozs. of gold to the ton, and the mining operations at the present time are said to be of a paying nature.

"About six miles northerly from Costerfield, and bearing as nearly as possible in the same line from the latter as the strike of the antimony reefs, are the Redcastle Reefs, which are likely to become very valuable mining properties.

"I consider it extremely probable that further discoveries of rich mineral veins will be made in the vicinity of Costerfield; but owing to the peculiar character of the country, which consists of low schist rises, and very broad sandy alluvial flats,

prospecting is attended with difficulties, as the reefs are not easily traced on the surface.

"If a careful geological survey were made of the locality, and the relative position, strike, and characteristics of the mineral lodes noted in such places as they can be found, I think much valuable information might be collected for the guidance of the miners in prospecting.

"I have attached a plan, showing the position of the Costerfield and Redcastle Reefs."

According to the returns received, the following quantities have been raised :—

ANTIMONY ORE.						Tons	lbs.
Previously—up to 31st December, 1866	-	-	-	-	-	2,549	26
From 1st January to 31st December, 1867	-	-	-	-	-	272	0
Total	-	-	-	-	-	2,821	26

The following statement of exports has been received from the Customs Department :—

ANTIMONY ORE.						Tons	cwt.
Previously—up to 31st December, 1866	-	-	-	-	-	1,482	12
From 1st January to 31st December, 1867	-	-	-	-	-	508	7
Total	-	-	-	-	-	1,990	19

About 868 tons have been exported during the past year (1868).

According to analyses, stibnite (sulphuret of antimony) contains 73 per cent. of antimony and 27 per cent. of sulphur; cervantite (oxyd of antimony) contains about 80 per cent. of antimony and 20 per cent. of oxygen; valentinite (white antimony) contains 84·32 antimony and 15·68 oxygen. Valentinite varies in color from white to pale cream color, ash-grey, pinkish-white, and brownish-white.

The metal is used largely in making alloys, such as type metal, stereotype metal, britannia metal, music plates, antifriction alloy for railway carriages, &c.

ZINC AND THE ORES OF ZINC.

Small nuggets of native zinc, coated with carbonate of lime and carbonate of zinc, have been found in some of the gold drifts in the Daylesford District and at Creswick, but the metal is probably of rare occurrence. It is said that a piece of native zinc, weighing 19 ozs., was taken from a cavity in basalt at or near Northcote; but doubts as to its true character are entertained.

BLENDE.—*Sulphide of zinc* occurs, according to Mr. Ulrich's notes, in Russell's Reef, near Malmsbury; Nuggety Reef, Tarrangower; Wilson's Reef, St. Arnaud; in the reefs at Morse's Creek, &c. "It is generally found in solid irregular patches, and in small veins of a pitch-black color with (in some specimens) specks of gold."

It contains from 55 to 67 per cent. of zinc, 2 to 8 per cent. of iron, from a trace to 2 per cent. of cadmium, and from 32 to 36 per cent. of sulphur. Its hardness is from 3·5 to 4.

LEAD.

Native lead is found in the auriferous drifts of the deep *leads* at Talbot and Avoca. Mr. E. J. Bateman has collected numerous specimens in the first-named locality, and Mr. Hall and Mr. Newman have got them again and again in the principal *leads* near Avoca. They occur as rounded water-worn and angular pieces, and many of them are studded on the surface with small grains of gold. Native copper is found with them and in the same way. At first it was doubtful whether these specimens occurred naturally in the washdirt; but Mr. Newman himself investigated the matter, and he assures me that they are to be found everywhere in the auriferous drifts near Avoca. He took the trouble to wash some of the stuff *in situ* in a drive, and he sent me the specimens of native lead which he thus obtained.

It is right to say that none of the specimens have yet been analyzed.

GALENA.

Galena (sulphide of lead) occurs in many of the reefs at Sandhurst; near Blue Mountain, with sulphide and carbonate of copper; in Gippsland; in Campbell's Reef, at Moyston; at St. Arnaud; and in many other localities.

Though it is of common occurrence, it has not been got anywhere in large quantities, except at St. Arnaud, where in the veins below the water-level it has been found in strings and patches. It is usually argentiferous, and at St. Arnaud it yields in some places more than 100 ozs. of silver per ton, but in other places much less.

Cerussite, pyromorphite, mimetene, anglesite, and other ores of lead are not uncommon in the reefs where galena is found.

These minerals and the modes in which they occur are of high interest to the mineralogist.

It is not improbable that, in Gippsland, workable veins of galena may be found; but up to the present time only cabinet specimens have been got from this district.

COBALT.

Earthy cobalt has been found in many parts of the colony in small quantities, but near Yea it occurs more plentifully. In December, 1866, Mr. Chas. E. Verdon discovered several specimens near Yea; and subsequently large amorphous and botryoidal masses in the bed of the Colonial Creek, and in the adjoining rocks. He informs me that he got pieces weighing from two to ten pounds, and that there were large quantities of it in many places. Much of the ground has since been turned over by the miners, and probably all the ore they found has been mixed with the spoil-heaps and lost.

I am not able to give an analysis of the ore found near Yea; but according to Mr. Cosmo Newbery's reports it would appear to contain from one to fourteen per cent. of cobalt.

Sir Wm. E. Logan states that in Canada the cobaltiferous pyrites, though containing only 0.5 to 0.6 per cent. of cobalt, is likely to be wrought. By Mr. Macfarlane's method of treating the pyrites, it is estimated that about two-thirds of the small quantity of cobalt the pyrites contains can be recovered at a cost of \$14.00 per ton, and thus 8 lbs. of the oxyd, at \$3 per lb., would leave a large margin for profit.*

* *Geology of Canada*, by Sir Wm. E. Logan, pp. 506 and 750.

I have no information as to the present value of oxyd of cobalt in the European markets; but according to Mr. Robert Hunt, the keeper of mining records in England, the computed real value, in 1864, of seven tons of oxyd of cobalt was £10,963.

It is scarcely credible, having regard to its many uses in the arts, that it can have fallen so low since then as to render an ore yielding from one to fourteen per cent. quite worthless here.

BISMUTH.

Native bismuth is found at Omeo, in the basin of the River Yarra, at Kingower, and Tarrangower. Large pieces, some weighing nearly a pound, have been got at Wombat Creek, Omeo; and according to the reports furnished by Mr. Howitt, it appears to occur both in the veins and in the alluviums.

Carbonate of bismuth is found in the alluviums at Tarrangower and Kingower. In Tin-kettle *Lead* and Ramshorn Gully, Sandy Creek, Tarrangower, "it forms greyish or yellowish-white rounded and nodular pieces, from a few grains to several penny-weights, the larger of which show, usually on being broken, a dark color, tending to grey metallic in the centre."—(Mr. Ulrich.)

According to analysis made by Mr. Cosmo Newbery, its chemical composition is as follows:—

	I.	II.	III.
Oxyd of bismuth	87.22	85.13	76.22
Protoxyd of iron	0.34	1.28	4.31
Carbonic acid	5.55	5.10	3.28
Insoluble matter, clay, &c.	3.46	6.71	8.35
Water	3.43	2.13	6.83
	<u>100.00</u>	<u>100.35</u>	<u>98.99</u>

- I. Small grains of uniform color throughout.
- II. Larger grains with discolored centre.
- III. Piece half-inch in diameter with dark centre.

Native bismuth, which is the source of the metal used in the arts, has a hardness of from 2.0 to 2.5. It is brittle, with distinct cleavage, and of a silvery lustre and whiteness, but exhibiting a slight tinge of red.

The price of this metal has varied so much in the home markets that it is scarcely possible to say what it is worth now. Its price is probably less than 10s. per lb.

MANGANESE.

The ores of manganese occur in large quantities in many parts of the colony, both in the veins and in the alluviums. Fine specimens have been got at Pleasant Creek, at Daylesford, and in the basin of the River Yarra.

Many specimens of psilomelane from the Upper Yarra, having formed in cavities lined with crystals of quartz, exhibit casts of the crystals; and they are singularly instructive, when neatly divided in lines at right angles to the longer axis of any crystal whose cast is preserved.

Mr. Ulrich's notes on psilomelane are as follow:—

"This ore occurs very abundantly in mammillary crusts and concretions in the quartz reefs of all the goldfields. It also occupies in the auriferous conglomerates of

some localities the place of the common brown iron-ore in cementing the pebbles together—for instance, at the Hard Hills, Strangway's; the Shakspeare Hill, Tarilta, &c.,—and then often contains specks of gold embedded. In quartz reefs it appears as one of the most recently-formed minerals: as, wherever in contact, it forms coatings over most of the others (gold, quartz, chloro-bromide of silver, iron and arsenical pyrites, &c., 'diallogite' and 'cube-ore,' which have been found at Clunes coating it, being rare exceptions). From certain appearances in the drift heaps of recent workings on the Shakspeare Hill and the Hard Hills, its formation seems to be going on rapidly, even at the present day, as the surface of those heaps is dotted over with black patches and small concretions, the latter often connected together in, so to say, solid dendritical shapes. In the sands and clays it occurs in cylindrical pieces, composed of connected nodules, not unlike a series of knots on a string, sometimes flattened, sometimes elongated, the terminal nodules being generally more or less conical or pointed, imparting the idea that they are slowly growing or creeping onward through the matrix in which they occur. Frequently several of these cylindrical pieces are found like dendrites connected together. With regard to the latter in general, they are found abundantly distributed through the silurian slates and sandstones on every goldfield. The following are results of analyses by Mr. C. Newbery, of psilomelane, from several different localities:—

	I.	II.	III.	IV.
"Oxydes of manganese -	54.28	49.28	62.63	77.14
Sesquioxyd of iron -	20.16	18.73	10.31	6.03
Baryta - - -	2.51	4.21	0.20	11.33
Oxyd of cobalt - -	2.86	—	5.12	—
Oxyd of copper - -	0.92	1.21	trace	—
Lime - - - -	1.40	1.00	—	—
Alumina - - - -	—	5.12	—	1.43
Silica - - - -	6.21	8.91	4.60	3.05
Water - - - -	12.02	12.25	16.01	0.02
	<u>100.36</u>	<u>100.71</u>	<u>98.87</u>	<u>99.00</u>

"I. Specimen from Parkin's Reef, Tarrangower; forms mammillary crusts in crevices and joints of the quartz.

"II. Specimen from a quartz reef at Ramshorn Gully, Sandy Creek, occurring in narrow veins and mammillary crusts.

"III. Specimen from Strathloddon, forming fine botryoidal crusts in crevices of hard ferruginous silurian sandstone.

"IV. Specimens from Gippeland occur massive, containing cavities filled and coated with earthy matter.'

"A comparison of the results of these analyses shows, that the specimens do not only not agree amongst themselves, but differ still more strongly in chemical composition from European specimens—the principal distinguishing points, as regards the latter, being the considerable amount of iron and smaller quantity of manganese they contain (No. iv. makes a slight exception); though in outward appearance and general physical character there is hardly any apparent difference between the respective specimens. 'Psilomelane' from its variable chemical composition, is, however, generally not regarded as a well-defined mineral species; and though our colonial ore differs very greatly from the European ore, still it would not be advisable to separate it as a new species, though as a variety it would certainly deserve to be called *black ferro-manganese-ore*."

Pyrolusite occurs at Pleasant Creek and Ararat; and Mr. Bernhard Smith collected and forwarded to me a number of fine specimens in 1863.*

Wad is found on some of the goldfields; and quite a remarkable specimen of *diallogite* was sent to me by Mr. R. H. Bland some two years ago. The *diallogite* is of a rose-red color, and is found in mammillary and botryoidal incrustations on psilomelane and associated minerals. Manganese is used largely in the arts. In bleaching, in calico printing, and in the manufacture of flint-glass, it is of essential importance.

About 50,000 tons of manganese are imported annually into the United Kingdom, mostly from Holland and Spain; and the value per ton is about £3 10s.

MOLYBDENUM.

Molybdenite or sulphuret of molybdenum is found in a vein near Yackandandah, at Reedy Creek, at Maldon, and in the basin of the River Latrobe.

At Yackandandah fine hexagonal plates of molybdenite, some nearly half an inch in diameter, are found thickly embedded in a quartz vein which intersects the mass of granite forming the basin of Kinchington Creek. A mass of the granite with the intersecting quartz vein, richly studded with plates of molybdenite, was exhibited in the Intercolonial Exhibition.

It contains about 59·5 per cent. of molybdenum, and about 40·5 per cent. of sulphur.

It is very difficult to reduce the plates to powder; and they give a remarkable greenish colored streak when rubbed on porcelain.

The hardness varies from 1·0 to 1·5, and the specific gravity is about 4·5.

The ore has several useful applications in the arts; but owing to its rarity has not yet been availed of to the extent that it undoubtedly would be if it were cheap and plentiful. A pigment has been prepared from it, and it is used also in dyeing, and in the laboratory. The native sulphuret of molybdenum is said to be worth 14s. per lb.

IRON.

TELLURIC IRON.

Native iron—disseminated in very minute particles, and in small octahedrons—is said to occur in the basaltic rocks at Magnet Hill, Baynton's Station. It is probably of not rare occurrence in all the recent basaltic and volcanic rocks.

NICKELIFEROUS OR METEORIC IRON.

Two large masses of meteoric iron were discovered some years ago in a piece of land belonging to a Mr. Bruce, near Cranbourne. When *in situ* the pieces lay close together, and appeared to have at one time formed one large mass. They were separated probably by the decomposition of the smaller and narrower connecting piece.

The larger mass was estimated to weigh about four tons, and the smaller piece about half a-ton.

These valuable and highly interesting specimens excited the attention of scientific men in Melbourne, and an endeavour was made to obtain them for the National

* *Prospector's Hand-book*, 1863, p. 24.

Museum. The proprietor of the land, however, laid claim to them ; and though, as it appeared, he was very desirous of preserving them for scientific investigation, and of placing them in the National Museum, he was either misled by the persons who advised him, or misunderstood their intentions, and became so trammelled by promises, that he was unable to give effect to his good intentions. In order that the colony might not lose these unique specimens, the Honorable John O'Shanassy—at that time Chief Secretary of the Colony—appointed a Commission (of which the late Honorable George Samuel Evans, LL.D., was chairman), with instructions to investigate the claims of the discoverer and the owner of the land, and to report whether any steps could be taken to secure the meteorites for the National Collection. It was found, however, that it was impracticable to rescue them from the hands of the persons who had, without perhaps the full knowledge of Mr. Bruce, pledged them to the mother-country.

The larger mass is now in the British Museum—an object of vulgar curiosity, and by its removal made practically useless for purposes of scientific investigation.

The smaller piece is said to be still in the colony.

Mr. George Foord has been good enough to send me the following notes respecting the Bruce meteorites. They were written hurriedly, and when pressing engagements occupied nearly all his time, but they are nevertheless of lasting value. He says :—

“ Before this meteorite was removed I had seen it in site, and immediately after its removal I again saw it on the waggon on its way to Melbourne. Before and during its removal Mr. Daintree made admirable photographs of it, and he was good enough to favor me with a set of copies of them.

“ When I first visited the spot I saw Mr. Bruce, the owner of the meteorite, who took us out to it. It was to a great extent embedded in the soil, resting in fact on the bottom rock. The portion above the surface powerfully attracted the magnetic needle, and had local poles, so that in passing the needle over it the latter swung round, and became reversed in particular parts of the meteorite. One projecting upper portion of it showed a jagged or hackled surface, where a portion had been cut off ; and I was told that originally there was a projecting rounded mass at this part, as large as a child's head. This had been cut off by the smith at Cranbourne ; the same person, in fact, who had made the horseshoes from time to time as instanced in the one above referred to.* I saw the smith, who described the iron as easy to fashion but difficult to weld. He could make a good horseshoe from the metal, but he could not manage to weld on the tip. He must have cut off other portions besides the more or less spherical piece above spoken of ; for Mr. Bruce stated that, finding the latter in his possession, he effected re-possession of it, and had, in fact, forwarded it to Melbourne. Mr. Bruce eventually presented it to me, giving me an order for its delivery, which I presented at Mr. Norton's shop, in Collins-street east, carrying away the ponderous specimen. I caused it to be planed in half, so as to obtain a section without injuring the texture of the surfaces so exposed ; and the larger surface thus obtained I etched, and it was exhibited in our second Exhibition (that in Sir Henry Barkly's time), and was afterwards sent home, and exhibited in the 1862 Exhibition. It passed thence into the possession of Mr. F. A. Abel, of the War Department, and it was intended that a complete analytical examination of it should have been made, but that I believe has

* The smaller meteorite. This valuable specimen appears to have been mutilated again and again.

never yet been done. I cannot tell you much concerning its chemistry or structure ; but perhaps even the little I have to communicate may prove acceptable. When cut both graphite and iron pyrites were seen to map the exposed surface. When etched Widmanstethian figures were beautifully developed. When left exposed a solution of chloride of iron exuded from the pores, rusting the surface. When dissolved the so-called schreibersite* is left as a residue. It contains iron, nickel, cobalt in small but distinctly perceptible quantity, phosphorus, sulphur, carbon, chlorine, sodium, and possibly other constituents. I have not examined it for chromium, manganese, nor indeed for any other constituents than those above mentioned. In one of Daintree's photographs there is seen in the large Bruce mass a white spot in the meteorite itself. That spot was a white friable substance filling a cavity ; it was, in fact, carbonate of magnesia, probably resulting from the decay of olivine or some other magnesian mineral.

"One point concerning the structure of the meteorite is very curious, and is worthy of remark : when the planed surface was etched, an effect (*moiré metallique*) like that produced by wiping warmed tinned iron-plates with a sponge soaked in hydrochloric acid is produced. The surface is divided up into patches, each of which shows a crystalline texture, so that when holding the etched surface in the light, and turning it round in its own plane, certain of these patches become lustrous and reflective in certain positions, and dull in other positions, just as the crystalline outcrop catches the light at a favorable angle or otherwise. But it is a fact of an interesting character, that round each of these patches thus developed by etching, there is a thin marginal layer of pyrites, so that the whole mass, if such structure really obtains through the whole mass, may be considered as a congeries of individual metallic bodies, impacted and cemented together by an interstitial layer of pyrites.

"Concerning the chloride of iron exuding from the pores of the meteorite, that is probably no part of the original meteorite, but the result of the saltiness of the soil into which it has fallen ; or to its having originally fallen into the sea or a salt lagoon, from which alteration of levels has since raised it. The kind of action which seawater constituents are thus supposed to have exerted upon it, is exactly the same as what is taking place with cast-iron pipes, gas pipes for example, which happen to be buried in soil which is more or less of a salt character. After such influence they sweat out chloride of iron on exposure just in the same way.

"But if the composition of a meteoric iron can be gradually altered by the soil into which it falls, this raises a grave question as to the interpretation which we are to put upon its analysis, what materials we are to regard as properly its own, and what we are to consider as foreign, and, in fact, acquired. This would suggest the importance of ascertaining all within reach concerning meteoric iron which has fallen under such favorable circumstances as to allow of its examination before any change of composition can have taken place. But how rare are such examples, and how seldom does it happen that the fortunate observer of the fall has cultivated a habit of precise

* Phosphuret of nickel. Dr. J. L. Smith states that this mineral consists of phosphorus 13.9, iron 57.2, nickel 25.8, cobalt 0.3, copper *a trace*, silica 1.6, alumina 1.6, lime *a trace*, and chlorine 0.1. The conclusions drawn by Dr. Smith from this analysis are of great interest. This mineral could not occur in an atmosphere in which oxygen is present in any proportion approaching that found in the air we breathe ; and Dr. Smith suggests that meteorites in which schreibersite is found were formed in an atmosphere altogether different from that surrounding the earth, though not of course without some proportion of oxygen.—R.B.S.

observation. Take the newspaper notice which I send as an illustration of this. The observer is a clergyman, and evidently a person of superior intelligence; but observe what his testimony is worth when we come to look at it as a basis of scientific enquiry. He satisfactorily ascertains that its specific gravity is greater than that of iron, but at the same time he admits that his means of testing this question are so imperfect as to prevent his determining the exact ratio.

"Here I may add a few figures referring to the specific gravity of my fragment before it was cut into pieces. The following figures will speak for themselves.

It weighed 35 lbs. 9 ozs. 121 grs. avoirdupois.

The specific gravity of native iron is stated at	-	-	7	to 7.8
" " schreibersite	-	-	7.01	to 7.22
Meteoritic iron, according to Miller and Brooke	-	-	7	to 7.345
Iron wire, say	-	-	-	7.78
Two small fragments of Abel's meteoric iron	-	-	-	7.68
The large fragment as above (35 lbs. 9 ozs. 121 grs.)	-	-	-	7.5215."

Mr. Foord's observations—made for his own information—are all that I can add to this brief statement. That a meteorite of great size, of surpassing interest—and evidently exhibiting peculiarities of composition, if not of structure—should have been allowed to pass away from us as a thing of no value, is, I am bound to say, not creditable to us as colonists. Such an event we may rest assured can never happen again; and though it might be scarcely worth while to reclaim it, it is not beyond possibility that our great meteorite may yet again be re-purchased and added to the National Collection.

SPECULAR IRON-ORE.

Iron-glance occurs very sparingly in small tabular crystals in several reefs at Sandy Creek, Tarrangower, and in dolerite and dolerite-porphry near Malmsbury.—(Mr. Ulrich). Fine specimens of micaceous iron-ore have been obtained by Mr. District Surveyor Cooper from the Omeo district; and Mr. Ulrich says it is met with in veins in the metamorphic rocks of the Grampians, also near Lake Tyers, and in several other localities in Gippsland.

The crystals of specular iron have a hardness of 5.5 to 6.5; they are brittle; the streak is cherry-red to reddish-brown; and the fine particles in some cases are feebly magnetic.

The composition is nearly as follows :—

Red oxyd of iron	-	-	-	-	-	-	-	94.82
Protoxyd of iron	-	-	-	-	-	-	-	trace
Titanic acid	-	-	-	-	-	-	-	3.57
Protoxyd of manganese	-	-	-	-	-	-	-	1.61

The chemical composition of the pure ore is 70.03 iron, and 29.97 oxygen, but it is seldom found without some intermixture of chrome, silica, or oxyd of titanium.

RED OCHRE.

This ore is found in patch-like accumulations in the tertiary rocks around the coast.—(Mr. Ulrich.)

LIMONITE.

Quite large veins of brown iron-ore occur at Steiglitz and Castlemaine, intersecting silurian rocks ; and the ore occurs elsewhere on the goldfields in narrow veins and as nodular concretions in rocks of the same age. It is found also in considerable quantities in the tertiary strata at Flemington, Brighton, Bacchus Marsh, &c., and in the deep leads at Huntly, Myer's Creek, Indigo, Wahgunyah, &c., where it accompanies gold.

It not seldom forms the "casing" of quartz veins, and pieces of it are in many places included in the auriferous veins.

It is found plentifully in all localities where the older basalts have decomposed in place, and large pieces (apparently filling cavities in the rock) have been got from the more recent basalts at Malmsbury. A remarkable specimen of this kind was lately presented to the mineral collection of the Mining Department by Mr. Shakespeare, the resident engineer of the Coliban Water Works.

At Fryer's Creek, in the Mining District of Castlemaine, and at Major's Hill near Benalla, considerable quantities of hydrous peroxyd of iron have been discovered. At Major's Hill, according to a report furnished by Mr. Nicholas, mining surveyor, there is a vein of it, at least sixty feet in width, extending for upwards of a mile and a quarter ; and he estimates that there are about 200,000 tons of ore in sight. Limestone, he says, occurs in the same locality.

Limonite is massive, botryoidal or stalactitic. The hardness varies from 5.0 to 5.5. The color varies from dark-brown to ochre-yellow. The streak is yellowish-brown to dull yellow. Composition—red oxyd of iron 85.56, water 14.44. It usually contains a small proportion of silica. It yields by assay usually about two-thirds its weight of pure iron. Small pieces of hematite are frequently seen in quartz veins, derived doubtless from the decomposition of iron-pyrites.

The Belgian iron works are supplied by ores of this description ; and the iron is very suitable for the production of tin plates.

The iron obtained from this ore is generally *red-short*—a quality due, in all probability, to the presence of sulphur ; and when we consider the origin of the ore, the presence of sulphur in such quantities as to affect the quality of the iron is easily accounted for.

With an abundance of fuel we may look forward confidently to a large production of iron in this country, when the price of labor and materials admits of such enterprises being undertaken.

BROWN OCHRE

Occurs in cavities in quartz reefs, and in the tertiary rocks along the coast.—(Mr. Ulrich.)

BOG-IRON ORE.

Rather curious specimens of this ore have been got from the great swamp near Melbourne, and ore which was procured in 1854 is now in the collection of the Mining Department. Mr. Ulrich says that this mineral occurs in nearly all the lakes and swamps which receive the drainage of country occupied by basaltic rocks.

CLAYEY AND ARENACEOUS IRON-STONES.

Respecting these, Mr. Ulrich writes as follows :—"Clayey and arenaceous iron-stones are the most abundant, both in the silurian and tertiary rocks, forming beds, impregnated concretionary patches, &c. These latter appear in the silurian as

indurated, lenticular zones across the strike of the rocks (St. Arnaud), or more frequently are confined to irregular patches, extending only a few feet beneath the surface (Guildford, Malmsbury, &c.). Their origin appears to be principally due to percolation of ferruginous water from a former denuded covering of basalt.

"A peculiar variety of brown iron-ore, shot-like, or often pea or bean shaped concretions, is abundantly distributed over the surface of the basaltic plain of the Loddon valley and the slopes of the neighboring silurian ranges; it occurs also in great quantities throughout the extensive post-basaltic brown loam deposit which appears around the margin of the Murray River basin, and in the river-valleys of the Werribee, Loddon, Campaspe, Little River, &c. The following are results of assays and an analysis, by Mr. C. Newbery, of samples of brown iron-ore from different parts of the colony :—

	Per cent. Iron.
Brown hematite from Moonee Ponds contains	50.68
Bean-ore from Eddington, Loddon valley	44.34
Arenaceous iron-ore from Mordialloc	24.26
Brown iron-ore, round west bank of Saltwater river, contains	46
Brown iron-ore from Greenstone range, east of Lancefield	52
Brown iron-ore from Opossum Gully, South Muckleford	47.7
"Argillaceous iron-ore from Western Port gave by analysis :—	
Peroxyd of iron	55.14 = 38.598 per cent. of iron
Alumina and lime	10.62
Silica	24.17
Water	10.07
	100.00

ILMENITE, ETC.

Ilmenite, menaccanite, and iserine are found in considerable quantities in the basin of the River Yarra, in the upper parts of the River Werribee, in some of the streams trending towards Port Phillip Bay, at Tubba Rubba Creek, in the county of Mornington, in the beds of creeks near Berwick, and generally in the drifts on the goldfields.

Good specimens of titaniferous iron were collected in the Yarra basin by Mr. D. Jones, and Mr. Gladman, about five years ago, which I examined.

Ilmenite has a hardness of 5.0 to 6.0, and is generally more or less magnetic.

Its composition is variable :—

Titanic acid	from 12 to 59 per cent.
Red oxyd of iron	from 4 to 82 ..
Protoxyd of iron	from 4 to 46 ..
Protoxyd of manganese	from 0 to 3 ..

with in some specimens very small proportions of lime, magnesia, oxyd of chrome, silica, and oxyd of tin.

Iserine is harder, generally from 6.0 to 6.5. The titanic acid varies from 9 to 11 per cent., and the protoxyd of iron from 39 to 40 per cent. Exactly as described by Sir William Logan, we find here as in the auriferous sands of Canada, in "the black residue left after washing the auriferous sands, ilmenite mixed with chromic iron, rutile and magnetic and specular oxydes of iron."*

* *Geological Survey of Canada*, 1863, p. 502.

In May, 1864, I discovered amongst a number of specimens sent to me by Mr. Gladman, from the Yarra basin, the rather rare mineral brookite. It has since been found at Steiglitz, and we are not wrong, therefore, in assuming that the ores of titanium are more widely distributed than was formerly supposed.

"Titanium has hitherto received but few applications in the arts; and until within the last few years, during which large quantities of titanite iron-ore have been found in the Laurentian rocks of Canada and of Norway, it was comparatively a rare substance. Within two years, however, attention has been turned to the probable importance of small portions of titanium in improving the qualities of iron and steel; and Mr. Mushet has obtained several patents for certain modes of using the native ores of titanium and iron, and for obtaining alloys of the two metals. Experiments with the titanite iron ore from Norway are said to have been undertaken on a considerable scale, for the purpose of determining the value of these new combinations; but as yet no practical results appear to have grown out of this application of titanium.

"A compound was, in 1846, described by Elsner under the name of ferrocyanid of titanium, as a green paint; and it has recently been again brought into notice as a safe substitute for the poisonous arsenical green color now so much used. In Elsner's process, which is said to be patented in England, titanite acid, prepared by decomposing titanite iron ore by fusion with bisulphate of potash, and by subsequent purification and separation from iron precipitated from its hydrochloric solution by ferrocyanid of potassium at a boiling heat. By this means, a beautiful dark green pigment is obtained, which is, however, inferior in brilliancy to the arsenical copper green.

"In March, 1861, specifications for a patent were deposited in London, by Mr. F. Versmann, for the employment of the compounds of titanium as pigments or coloring materials. The details of his processes are not known to us. Several finely-colored bodies, besides the green ferrocyanid just noticed, have however been obtained from titanium. Thus the action of gaseous ammonia upon titanite acid, heated in a porcelain tube, gives rise to a stable nitrid of titanium of a violet color; and when fused with vitrifiable substances in presence of metallic tin, titanite acid gives rise, according to Karsten, to a beautiful deep blue enamel. This resembles the smalt which is prepared with the oxyd of cobalt, and it may perhaps be made to replace it.

"The sulphuret of titanium, prepared by the action of sulphuretted hydrogen upon the bichlorid, is a beautiful bronze or gold-yellow substance, which crystallizes in scales, has a metallic lustre, and resembles the sulphuret of tin, known as mosaic gold. From the cheapness and facility with which titanium and its compounds may now be obtained, it may be presumed that before long this substance will find numerous applications in the arts."*

CHROMITE.

Minute octahedrons of chrome iron are found in many of the gold drifts. Decomposed they give a green color to quartz at Melvor; and at Strathloddon there is a mass of chrome ochre, in which occur nests filled with small black octahedrons.

It is possible to procure from many places clean samples of the octahedrons. The hardness is about 5.5, and it is sometimes slightly magnetic. The oxyd of chrome

* *Geological Survey of Canada*, p. 753.

varies in different samples from 43 to 60 per cent.; alumina from 3 to 13 per cent.; protoxyd of iron from 18 to 35 per cent.; magnesia from 5 to 18 per cent., with in some specimens minute proportions of silica and protoxyd of chrome. This ore is chiefly used for the production of chromate of potash; a salt from which various other preparations used in the arts are manufactured.

It is said to be worth from £10 to £12 per ton.

It is probable that it will not repay the miner to collect this ore, unless masses of it be discovered similar to those which are found in New Zealand.

SPATHIC IRON.

From observations made by Mr. Geo. F. Ulrich, it appears that CHALYBITE forms the lodestone of the copper pyrites vein in Joss and Company's claim, Eaglehawk, Maldon, and that it occurs also sparingly in small rhombohedrons with curved faces in crevices and joints of Lisle's Reef, near Mount Tarrangower. Massive patches of this mineral have also been reported from some of the reefs at St. Arnaud. The variety sphærosiderite is found in the basalts at the Loddon, Sunbury, Campaspe Falls, Ballan, and other places. Nodular masses of this mineral occur also in the mesozoic coal measures near Geelong.

PHARMACOSIDERITE

Is found in drusy coatings of brownish red subtransparent crystals (cubes) up to one-eighth of an inch in size, in the Port Phillip Company's mine, Clunes, covering quartz and black manganese ore.

Perfect cubes of pharmacosiderite of various shades of green, very rarely reddish-brown, occur associated with arsenical pyrites in cavities of the Beehive and German Reefs at Maldon, the Armenian Reef at St. Arnaud, and several of the reefs of Maryborough, Sandhurst, and Crooked River.

SCORODITE

Is found in the Abe Lincoln Reef at Crooked River, in Blucher's Reef at Maryborough, and in the Beehive Reef at Maldon.

NONTRONITE

Has been obtained from Brewer's Reef at Maldon, and in the silurian bed-rock in Pretty Sally's *Lead*, Maldon.

COPPERAS

Occurs in groups of light bluish-green, very irregular crystals, in crevices of the Beehive Reef, Maldon, where it evidently has proceeded from the decomposition of iron pyrites, which at that particular spot is very abundant. Tested before the blowpipe, it affords small traces of copper.

BASIC SULPHATE OF IRON.

"This mineral, which is, no doubt, also a product of the decomposition of iron pyrites, impregnates, or rather is disseminated, through certain beds of the upper miocene formation near Point Addis, Geelong, to such an extent (above 50 per cent.) as to render it probably of commercial importance. The beds have the appearance of

yellow sandstone, and an analysis of a sample by Mr. R. Daintree, the discoverer of the deposit, gave the following results :—

Sulphuric acid	-	-	-	-	-	-	-	18·278
Peroxyd of iron	-	-	-	-	-	-	-	28·495
Potassa	-	-	-	-	-	-	-	4·092
Water of constitution	-	-	-	-	-	-	-	6·935
Water of combination	-	-	-	-	-	-	-	0·850
Insoluble residue	-	-	-	-	-	-	-	41·350
								100·000

Rejecting moisture and insoluble matter, the contained mineral will give :—

Sulphuric acid	-	-	-	-	-	-	-	32·758
Peroxyd of iron	-	-	-	-	-	-	-	47·482
Potassa	-	-	-	-	-	-	-	7·332
Water	-	-	-	-	-	-	-	12·428
								100·000

According to this latter result the mineral does not (except as regards sulphuric acid) correspond in chemical composition with any of the species generally classed under '*copiapite*' (*fibroferrite*, *stypicite*, &c.); however, as these latter are not considered well-defined chemical compounds, and as from its mode of occurrence the mineral under notice could not be analysed *per se*, and some of the iron and potassa may therefore have come from the rock material through which the mineral is disseminated, we should hardly be justified in naming it as a new species." *

VIVIANITE.

Specimens of this mineral (phosphate of iron) were brought to me by Mr. Richard Davis in December, 1863. He said he obtained them from the basaltic rocks of Phillip Island (Western Port). There are considerable quantities of guano resting on decomposed basalt in many places in the Island, and the presence of this mineral in nests and cavities is no doubt due to the decomposition and fresh combination of the organic and inorganic matters.

Mr. John Lynch, of Smythesdale, has forwarded specimens of vivianite from his district.

IRON PYRITES.

Iron pyrites, bisulphuret of iron, cubic pyrites or mundic, occurs plentifully in all the veins on the goldfields, and at Sandhurst it forms in some places the lodestone. In soft slates, and in the bounding rocks where quartz reefs are found, it is abundant.

Whether found in sandstone or slates, in veins, or as secondary pyrites in alluvial or tertiary deposits—whether got from the silurian, mesozoic, or tertiary strata—it is nearly everywhere auriferous, yielding from a few grains to several ounces of gold per ton. In some places it is argentiferous, and gives more than 1 oz. of silver per ton.

* *Mineral Species of Victoria*, by Geo. H. F. Ulrich, Esq., F.G.S. The localities of chalybite, pharacosiderite, scorodite, and nontronite are taken from his notes.

Except at such works as those at Clunes, where this mineral is saved, and subjected to processes whereby the greater part of the gold is extracted, it is a hindrance to the miner, and a perpetual source of anxiety to him. It is rapidly reduced to powder under the stamps, and he finds it difficult to separate it from the quartz, and to save it even when he tries to do so; and having saved it, it is not always easy so to treat it as to get the gold from it with profit. An enormous quantity of gold is lost every day by the quartz-crusher; and until miners generally begin to use such appliances as have been devised by Mr. Thompson and Mr. Ulrich, they must be content to see a considerable part of the fine gold disappear with the waste from their mills.

It has often been suggested that the pyrites should be treated exactly in the same way as similar ores are dealt with at home for the production of alum, sulphur, and sulphate of iron. Stacks could be made of alternating thin layers of pyrites, aluminous shales, and fuel (such as gum leaves, gum branches, &c.); and while it might even now be profitable to save the resulting chemical products, it is certain that this method would render the ore more tractable under operations as now conducted, and allow of the gold being got by amalgamation with mercury without much loss. The length of time necessary for the proper treatment of the ores after this method has probably prevented our quartz miners from trying it. In this colony the miners look for immediate results, and they would not be willing to watch for a year or two the progress of any experiment of this kind.

The process, however, is so simple, and as conducted in America so certain in its results, as to lead to the hope that no long time will elapse before a fair trial is given to it in this country. No difficulty need be apprehended from the scarcity of fuel, because gum leaves and brushwood are plentiful everywhere, and these would be quite suitable for keeping up a slow combustion.

Not alone from the reefs, but also from the alluvial deposits, great quantities of pyrites may be got without much cost. Mr. Clow, the warden at Steiglitz, reports that there has been found, about three miles east of Gordon, a stratum of secondary pyrites and clay, nine feet in thickness, which it is estimated will yield several ozs. of gold per ton; and at Smythesdale, in some parts of the Yarra basin, and elsewhere, the mineral is abundant both in the veins and in the alluviums.

We cannot hope that works for the treatment of this mineral will be commenced in this colony until there is some change in the labor market; but the day may arrive sooner than is now anticipated, because the gold, silver, and copper, which our pyrites contains, give it a higher value commercially than that of any imported into the United Kingdom.

Nearly 300,000 tons of pyrites are annually consumed in the United Kingdom in the alkali manufactures alone; of which about 140,000 tons are obtained from the mines of England, Ireland, and Scotland, and immense quantities of cupriferous pyrites are imported from Spain.*

* The silurian country in Andalusia, where occur remarkable deposits of iron pyrites, very closely resembles some parts of Victoria. "The rock of the district is clay-slate, silurian in age, bedded but not cleaved; talcose and micaceous slates are also met with, and here and there beds of quartzite. The strata rear up at very high angles, and are much contorted—but I was told that a general north-easterly and south-westerly strike could be traced. Over the slate tract are scattered many masses of porphyry of different kinds, passing here and there into diorites, accompanied at some points by masses of cupriferous iron pyrites, which at the surface are represented by

The value of the English ores varies from 10s. to 20s. per ton; and some parcels of the Spanish ores are probably of still greater value, containing as they do variable quantities of copper pyrites.* The average, however, of the pyrites of the Riotinto mines is less than two per cent. of copper, but in other parts the mineral is much richer.

The sulphur, sulphuric acid, and copperas (sulphate of iron) obtained from pyrites, and the several products dependent upon these, occupy a large space in the statistics of the United Kingdom, and hence the importance attached to this mineral as a future source of wealth in this country.

The hardness of common pyrites varies from 6·0 to 6·5, and the specific gravity from 4·9 to 5·1.

Its composition is nearly as follows:—

Iron	-	-	-	-	-	-	-	-	-	47·00
Sulphur	-	-	-	-	-	-	-	-	-	53·00
										100·00

Relatively small proportions of gold, silver, arsenic, silicon, and selenium, are found in many specimens.

MISPICKEL.

In the Whip Reef at Sandhurst; at Castlemaine; in several reefs at Tarran-gower; at Steiglitz; in reefs at Donnelly's Creek, Stringer's Creek, and at Wood's Point; at Blue Mountain; at St. Arnaud; in many parts of the Beechworth District; and in the reefs near Pleasant Creek, great quantities of arsenical pyrites are found. It generally accompanies gold, and in most places is highly auriferous.

The composition of mispickel is nearly as follows:—

Iron	-	-	-	-	-	-	-	-	-	35·00
Sulphur	-	-	-	-	-	-	-	-	-	20·00
Arsenic	-	-	-	-	-	-	-	-	-	45·00
										100·00

Its hardness is less than common iron pyrites—usually 5·5, and the specific gravity is higher—from 6·0 to 6·3.

masses of oxyd of iron." * * * * * —Mr. A. H. Green, M.A., F.G.S., in *The Quarterly Journal of Science*, October, 1868. Mr. Green's description of the country—given more in detail in other parts of his paper—would lead to the conclusion that the original formation of it, and the changes effected by denudation, were in no manner different from what are observed in some of the auriferous tracts of Victoria. It is probable that the diorite dykes of Andalusia are intersected by veins of quartz, similar in character to those at Wood's Point. Spain—as regards her mineral treasures probably the richest country in Europe—has long lain neglected; but having before them the results lately obtained from the gold mines of Italy, it is just possible that her people may seek to re-open the old goldfields and to discover new deposits. If this should happen, it is not unlikely that some of our skilful quartz-crushers, and those experienced in deep lead mining, may carry their knowledge thither, and teach in the old country what they have learnt in the new.

* The coppery pyrites from Ballygahan, County of Wicklow, Ireland, is worth, according to Mr. Robert Hunt's statistics, about 20s. per ton.

Mispickel and other forms of arsenical pyrites are used for the production of arsenic and arsenious acid (the white arsenic of commerce); the latter being used largely in the preparation of pigments.

Arsenic is valued in England at 15s. per ton, and about 1,800 tons are produced annually from the mines of Cornwall and Devonshire.

PYRRHOTINE.

In 1863, when examining the reefs at Maldon, I brought away many samples of pyrites, and amongst them I found pyrrhotine. It has since been got from the reefs at Castlemaine, at Mount Howqua, and other places. It is generally highly auriferous. The hardness of the specimen I examined was 4·5; but it is sometimes as low as 3·5. The specific gravity is 4·5 nearly.

It contains sixty per cent. of iron and forty per cent. of sulphur. Some specimens show traces of nickel, cobalt, manganese, and copper.

FRANKLINITE.

This mineral, which contains about sixty-six per cent. of red oxyd of iron, sixteen per cent. of oxyd of manganese, and about eighteen per cent. of oxyd of zinc, is probably of rare occurrence in the colony. Amongst some samples sent to me for examination, I detected a granular mass having the characteristics of franklinite; and from a blowpipe examination I believe it to be this ore. The locality from whence it came is not known.

WOLFRAM.

The double tungstate of iron and manganese—wolfram, is found in the reefs of some of our goldfields. It occurs in quartz reefs in many localities. Sandhurst, Tarrangower, and the basin of the River Yarra are the principal localities now known. It is sometimes found intermixed with quartz, and accompanying schorl, iron-glance, bismuth, &c.

It is opaque; the fracture is uneven; and it is brownish-black in color. The streak is reddish-brown to black; and the lustre adamantine inclining to metallic. Hardness, 5·5; specific gravity, 7·0 to 7·5. It is sometimes slightly magnetic.

Composition :—Scheelic acid	-	-	-	-	-	76·00
Protoxyd of iron	-	-	-	-	-	10·00
Protoxyd of manganese	-	-	-	-	-	14·00

The proportions of protoxyd of iron and protoxyd of manganese vary in different specimens, and in some, traces of lime and magnesia are found.

By exposing tungstic acid, at a bright-red heat, in an iron or glass tube, to a current of hydrogen gas we get tungsten, one of the heaviest metals, the specific gravity being 17·50, next after iridium, and little below gold.

Wolfram, from its high specific gravity, is with difficulty separated from the ores of tin.

Quite lately Mr. Smith Tibbetts has sent me large pieces of wolfram with quartz, obtained, I believe, from some vein in the Smythesdale District. It is found commonly associated with molybdenite. Tungstate of soda is used in calico printing, and, as an anti-combustible, is applied to textile fabrics.

Metallic tungsten and the native alloy of tungsten are used for the manufacture of metallic alloys. Melted with cast-steel or iron the resulting product is remarkable for hardness, density, and tenacity.

In the *Mineral Statistics of the United Kingdom* for 1866 the value of the wolfram raised at East Pool, Cornwall, is set down at £5 per ton, and in 1867 at £6 per ton.

Scheelite has been found in crystals of quartz taken from Bradford Lead, Maldon. —(Mr. Ulrich.)

The proportion of scheelic acid varies from seventy-five to eighty per cent., and the lime from eighteen to twenty-one per cent. Traces of red oxyd of iron, oxyd of manganese, and silica are usually observed.

COAL AND LIGNITE.

COAL.

The districts occupied by coal-bearing rocks have been described in another part of this paper, and it only remains to give some account of the quantities of coal which have been raised and brought to market.

According to the returns received the following quantities have been raised :—

	Tons.
Previously—up to 31st December, 1866 - - - -	1,933
From 1st January to 31st December, 1867 - - - -	nil
	1,933

That the total quantity is less than 2,000 tons is due solely to the difficulties in the way of exploration, and the costs belonging to the working and transport of such a mineral from the localities where it occurs to the market in Melbourne.

The quality of the coal found at Cape Paterson is very good. According to analyses made by the late Mr. Charles Wood the constituents are as follows :—

	ROCK VEIN. Mineral black and hard, and containing pyrites.	QUEEN VEIN. Softer than the Rock Vein, and containing less pyrites.
Hygroscopic water - - - -	2.43	4.0
Volatile matter - - - -	36.83	28.8
Fixed carbon - - - -	54.37	56.4
Ash - - - -	6.36	10.8
	99.99	100.0

These are good gas-coals, and certainly might compete successfully with the coal brought from Newcastle in New South Wales.

The mineral found at Traralgon has been analysed by Mr. Newbery, with the following results :—

Moisture - - - -	1.85
Volatile matter - - - -	35.98
Fixed carbon - - - -	53.45
Ash (white) - - - -	8.72
	100.00

Mr. Newbery observes that this coal closely resembles the Virginian bituminous coal, which, like the latter, is bright-black, rather hard, with small conchoidal fracture, burning readily with a bright flame, and yielding a good coke.

BITUMINOUS SHALES.

Bituminous shales occur in those parts of the country which are occupied by coal-bearing strata. The color is light-brown to dark-brown and black; and the composition of them varies considerably.

Mr. Cosmo Newbery has examined some of them, and reports as follows:—

	I.		II.	III.	IV.
"Carbon - - -	66.74	- Hygroscopic water - -	3.38	- 5.57	
Hydrogen - - -	4.83	- Volatile matter -	35.74	- 22.80	4.17
Oxygen and nitrogen	5.20	- Fixed carbon -	42.68	- 36.13	1.99
Sulphur - - -	1.65	- Ash - - -	21.58	- 37.69	88.00
Ash - - -	21.58				
	100.00		100.00	100.00	99.73

"I. Dried specimen of Traralgon shale.

"II. Raw specimen of Traralgon shale, of a dull-black color, with small specks of bright coal disseminated through it; fracture slaty, indistinct fossil marks, contains about four per cent. of hygroscopic water.

"III. Cape Paterson shale; has a dull-black color, conchoidal fracture, burns with a yellow flame, and forms a good coke.

"IV. Cape Paterson shale; brown color, slaty fracture, does not burn readily."

I am not aware that any complete analysis has been made of the carbonaceous shales which occur in the Cape Otway District, where we may anticipate the discovery of oil-yielding shales of economic value.

From information furnished by the Honorable the Commissioner of Trade and Customs, it appears that from 600,000 to 700,000 gallons of kerosene oil are annually imported from abroad; and as kerosene shales can be got both in this colony and in New South Wales, Mr. Patrick Hayes, an enterprising manufacturing chemist, lately erected extensive works, at great cost, near Footscray; but though he was able to produce an article said to be in every way equal to that imported, his adventure was not successful. The large yields from the mineral springs of America so lessened the price of the oil as to prevent him from competing successfully with the importer.

At some loss to himself he demonstrated the practicability of manufacturing mineral oil in the colony; and it is to be hoped that his plans may hereafter be so altered as to enable him to undersell the foreigner.

LIGNITE.

At Lal-Lal there is a bed of lignite more than 100 feet in thickness. The mineral is brown and nearly black in places, and might be called brown coal; and in other parts there is a great quantity of branches of trees, altered wood, and fossil resin, with here and there thin seams of jet. The bed is compact, there is not much pyrites, and only a very few thin seams of clay. It is not possible to state the area occupied by this valuable seam, but it is probably large.

Mr. John Christian Lyons states that underneath the third basaltic rock, at a depth of 230 feet, in the Old White Horse Lead at Ballaarat, there is a deposit of volcanic ash with much decomposed vegetable matter. The specimens he has sent are

remarkable. The ash is very fine and in thin layers; and between every layer there is a good deal of what appear to be grass and leaves. Some iron pyrites occurs also with the vegetable remains.

In the deep leads at Creswick, Ballarat, Daylesford, Morrison's, Mount Greenock, Raglan, &c., there are deposits of fossil wood; and deposits of lignite occur also in the Cape Otway District, and in Gippsland. Some of these are thick and of great extent.

We have not as yet discovered any cuprififerous lignites such as are found in New Brunswick and Nova Scotia, and described by Mr. Henwood.*

Cuprififerous lignites are found in Pennsylvania, in the State of New York, in Russia, in some parts of Germany, and in Ireland.

Our lignites are remarkable for the quantities of fossil resin and amber which they contain. Mr. J. F. Coleman, mining registrar, reports that amber is to be found about eight miles north of Rokewood, and five miles south-east of Staffordshire Reef; but the deposit has not been explored.

Analyses made by Mr. Charles Wood and Mr. Newbery show the composition of our lignites to be as follows:—

	I.	II.	III.	IV.	V.	VI.	VII.	
Fixed carbon -	29.3	27.9	26.7	38.5	39.0	35.17	Carbon -	66.10
Volatile matter -	20.7	22.1	23.3	20.0	20.4	41.25	Hydrogen -	5.11
Hygroscopic water	48.7	48.7	48.7	40.0	40.0	17.73	Oxygen -	18.40
Ash - - -	1.3	1.3	1.3	1.5	0.6	5.85	Nitrogen -	0.56
	100.0	100.0	100.0	100.0	100.0	100.00	Sulphur -	2.72
							Ash -	7.11
								100.00

"I., II., and III., analyses by Mr. Charles Wood of brownish-black, earthy-brown coal from Lal-Lal, gives per ton about 5,500 cubic feet of inflammable gas, which being however largely contaminated with carbonic acid and carbonic oxyd, and probably atmospheric air, burns with but little luminosity. The latter part of the aqueous distillate was of a fine carmine color, which was discharged by acids and reproduced by alkalies. This is due to an organic basic body not yet determined. The color is very unstable, and of no use in the arts.

"III. and IV., analysis by Mr. Charles Wood of the woody variety of lignite from Lal-Lal. The sample retained, after drying, its original woody structure, and even its brightness to a certain extent; it is very sectile, and when cut presents a compact smooth surface, exhibiting the marking of wood. When heated with a solution of potassa, it is partially dissolved, giving a dark brown liquid; with strong nitric acid it is entirely dissolved, giving rise to the evolution of copious nitrous fumes.

"VI. and VII., analysis by Mr. C. Newbery of lignite from a seam fifty-five feet thick, on Cross-over Creek, Gippsland. This lignite has a dull-black color, conchoidal fracture, is brittle, and burns only at a high temperature, with a yellow flame; it forms no coke.

"VI. is the analysis of the raw lignite.

"VII. is the analysis of the lignite dried."

* *Transactions of the Royal Geological Society of Cornwall*, 1840.

These deposits have not yet been so treated as to render them of economic value in the colony. This is to be regretted. Large areas of lignite lands are now held under lease from the Crown, and strange to say the products are sent to Ceylon and to the Mauritius to enrich the coffee and sugar plantations. Lignite and fossiliferous volcanic ash, with comminuted fossil shells from the Moorabool, are now regularly exported as manures.

According to the returns received from the lessees the following quantities of lignite have been raised :—

	Tons.
Previously—up to 31st December, 1866 - - - -	235
From 1st January to 31st December, 1867 - - - -	nil
Total - - - - -	235

The quantity raised during 1868 was not large.

MINERAL PITCH.

Bitumen is found near Portland, in the basin of the Bass River, and in caverns in the Pyrenees and the Grampians.

Some specimens from the Bass River resemble hardened tar.

The mineral caoutchouc—which occurs near the mouth of the River Murray, in South Australia, is altogether different in character from the asphaltum-like bitumens found in this colony.

GRAPHITE.

In some of the reefs on the goldfields there are found, near the walls of the quartz veins, seams of black schist, containing much carbonaceous matter—in some cases amounting to nearly twenty per cent., but no pure plumbago has been reported as having been discovered in the colony.

In some of the leads at Ballarat, a scaly substance resembling graphite is sometimes met with.

CLAYS.

KAOLIN AND OTHER CLAYS.

Kaolin is found at Bulla-Bulla, about fifteen miles from Melbourne. On November 3rd, 1855, I examined and made a report on a sample of this clay, which was discovered by Mr. Clement Hodgkinson, then District Surveyor for Melbourne, and now Assistant Commissioner of Lands and Survey. The report was published in the *Argus*. Mr. Hodgkinson furnished an excellent sketch section showing the mode of occurrence of the clay. The best portion lies on the east side of the stream, which has cut a channel through the granite and the overlying basaltic rock. The clay, which is quite white, is found *in situ*. It has not been washed down, freed from the quartz grains and re-deposited, like the best deposits in Cornwall and elsewhere; and necessarily requires some treatment before it becomes fit for fictile manufactures. There is an immense quantity of it; and all through it are found magnesite, and milk-white semi-transparent pieces of chalcedony—which, where hollow, exhibit very small transparent hexagonal crystals of quartz in the upper and lower surfaces of the cavity. Some attempts have been made to prepare the clays found at Bulla-Bulla for market:

but success has not attended the operations. By-and-by this mass of clay will be properly wrought; and the site will become a scene of active industry.

A fine clay, resembling meerschaum, was brought to me some years ago by a miner who was prospecting the southern sources of the River Yarra (near the Woori-Yaloak), but the exact locality and other particulars connected with the discovery were not made known, owing to the untimely death of the discoverer.

At Dunolly, in the mass of granite near Kyneton, and in other parts of the colony fine clays, due to the decomposition of granite in place, have been discovered from time to time; but all attempts to turn them to profitable account have failed.

The clays resulting from the decomposition of basalt, and the pipe-clay of the miners (decomposed mudstone), are very different from that found in the granitic districts, which is derived from the decomposition of felspar.

The kaolin found in Devonshire, which resembles the kaolin of Bulla-Bulla, is composed of 44 per cent. of silica; 37 per cent. of alumina; about 1·55 of lime, magnesia, and potash; traces of iron and manganese; about 2·5 per cent. of water; and a non-argillaceous residue, varying with the character of the clay. In many clays the per centage of water (usually with some alkali) is as high as 12, 15, and 30.

Fire-clay is found at Lal-Lal. A stratum, about three feet in thickness, overlies the lignite deposit; and it could be easily wrought.

The late Mr. Charles Wood made an analysis of this clay, and found the constituents to be as follows:—

Insoluble silica of alumina	-	-	-	-	-	92·60
Soluble silica of alumina	-	-	-	-	-	1·33
Oxyd of iron	-	-	-	-	-	trace
Soluble silica	-	-	-	-	-	0·53
Water of constitution, driven off at a red heat	-	-	-	-	-	5·80
						<u>100·26</u>

The following return shows the quantity of kaolin clay which has been raised at Bulla-Bulla:—

	Tons.
Previously—up to 31st December, 1866	1,757
From 1st January to 31st December, 1867	nil
Total	<u>1,757</u>

According to the returns from the Customs Department, 2 cwt. of kaolin were exported during the year 1867; but it is not known from whence it was procured.

Brick-earths, clays suitable for the commoner kinds of earthenware, tiles, pipes, flower-pots, &c., are common enough; and in many places are extensively wrought.*

* Mr. John S. Denbigh, one of the officers of the Mining Department, has, at my request, collected some useful facts relative to the operations of persons engaged in the production of building materials, &c. He estimates the annual production of common bricks at 39,000,000, the principal brick-making localities near Melbourne being Brunswick, Hawthorn, Simpson's road, Prahran, and Malvern. Delivered, the value of the above production would amount to £78,000. About 500,000 fancy pressed and moulded bricks, corbels, trusses, &c., are manufactured yearly (mostly at Brunswick); about 100,000 plain white and red pressed bricks; 120,000 flooring tiles; 400,000 feet lineal of glazed earthenware pipes for drainage purposes, as well as unglazed pipes, chimney-pots, jars, bottles, and the commoner kinds of ware; and about 300,000 fire-bricks (mostly at Richmond) as well as fire-lumps of various sizes, fluted and plain backs for register stoves, crucibles, dampers for flues, retorts, &c., bringing the total value of the yearly production to nearly £100,000.

Our manufacturers have almost driven the foreigner out of the market.

SLATES.

FLAGS AND ROOFING SLATES.

Roofing slates are found on the banks of the River Moorabool, at Gisborne, Pleasant Creek, Sandhurst, and in several other places where the older sedimentary rocks have been metamorphosed; and large tracts of land have been taken up from time to time under lease from the Crown, with the view of working these deposits and bringing the slates to market; but not one of the enterprizes has as yet proved successful. The slates which have been got are hard, fissile, and not very uneven in texture; but they are nearly double the weight of the Adelaide and Welsh slates; they are not even in color, and they are spoiled often by crystals and patches of sulphide of iron.

They are small, too, and they absorb both at the ends and on the sides a good deal of water.

It is true that none of the quarries have been properly opened up; and from the appearance of some of the specimens sent to me I am inclined to believe that, at no great depth from the surface, good roofing slates will be obtained.

According to the returns received, it appears that the following quantities have been raised:—

		Slates.	Tons.
Previously—up to 31st December, 1866	- -	1,000	and 125
From 1st January to 31st December, 1867	- -	—	—
Totals	- -	1,000	125

Good flags are to be got at Castlemaine, Maldon, Sandhurst, in the Beechworth District, and elsewhere in places where the older sedimentary rocks abut on granite.

The following quantities have been raised:—

	Tons	cwt.	Square yards.
Previously—up to 31st December, 1866	69	0	34,500
From 1st January to 31st December, 1867	431	15½	10,000
Totals	500	15½	44,500

The 10,000 square yards raised in 1867 are thus described:—Hearthstones, 1,560 yards; coreing, 2,000 yards; and paving, 6,440 yards.

It is not probable that, except for some peculiar purposes, there will be any large demand for flagging of the description obtained from sedimentary beds.

An enterprising firm has established saw-mills at Footscray (on the Saltwater River), where large blocks of basalt (bluestone) are cut into flags, so even in form, and so well suited to ordinary purposes, as to enable the company to compete with the colonial quarryman or the foreign importer. I have no accurate information as to the cost of preparing flags in this manner; but it is probable that it is not large, as quite large contracts have been made and completed by the saw-mill owners.

The basalt, when sawn and prepared, presents a good appearance; and as the rock is tough and hard, it will wear well.

Flags—formed of thin sheets of basalt or lava—occur near Lake Korangamite. When raised and squared they are fit for use.

MISCELLANEOUS MINERALS.

SULPHUR.

Small quantities of native sulphur have been found in the antimony reefs at Costerfield, in the reefs at Maldon, at St. Arnaud, and Castlemaine.

Lately quite a large piece of native sulphur, of a grey color, was sent to me by a gentleman engaged in mining operations; but though he gave information as to the locality where it is to be got in quantity, I am not at present at liberty to disclose it.

This mineral is probably much more generally distributed than is supposed.

MAGNESITE.

Mr. R. L. M. Kitto, M.L.A., formerly mining surveyor at Fryer's Creek, in a letter addressed to Lieut.-Col. Bull, from whom I sought information relative to the mode of occurrence of carbonate of magnesia in his district, states that "The exact situation is near the crossing of the Jim Crow Creek at Strangways, about thirteen miles from Fryerstown. I found magnesia there in considerable quantities, some lying on the ground (left by the prospectors), as well as several layers in the various shafts opened in the vicinity. These shafts give a good sectional view of the ground. It occurs in layers more or less horizontal, varying in thickness from three inches to two feet. * * * * Some of the magnesite is in a state of conglomeration, while in other instances there are layers that may be scraped away with the finger. In the latter case it looks like a layer of pearl barley, surrounded by gravel, conglomerate, &c."

This appearance, not inaptly described by the mining surveyor, is due to the influence of the atmosphere on a bed of clay containing silicate and hydrate of magnesia. The lumps are covered with very small rounded nodules, exhibiting in some cases rhombohedral planes.

I instituted these enquiries at the request of the Aërated Bread Company, in whose trade this mineral is used for the production of carbonic acid.

Magnesite, formed probably in the same way, is found in considerable quantities in the kaolin clays at Bulla-Bulla, where, in company with Mr. William Clarke, I collected a great many specimens some years ago.

In many of the tertiary clays on the sea-coast, and elsewhere, this mineral is not rare.

Epsomite, brucite, and other allied minerals have been discovered in small quantities; but they are more interesting to the mineralogist than to the miner.

GYPSUM.

Sulphate of lime, in the form of selenite, occurs in the Murray tertiaries westward of the River Wimmera; as gypsum in the Great Swamp near Melbourne; as thin scales in the joints and planes of bedding of the palæozoic rocks in the valley of the Moonee Ponds; in considerable masses on the coast south-west of the outlet of Lake Connewarre; and in the Cape Otway District.

It also occurs about twenty miles N.N.W. of Inglewood.

Casts of shells of miocene age in beautiful yellowish transparent selenite, were collected by the late Dr. Becker in the Western District.

Lately an attempt has been made to work the deposits of gypsum in the Cape Otway District; and the prospectors say that their enterprize is likely to be successful. They hold a searching license.

ALUNITE.

Alunite is found in some places forming small veins in black pyritous schist. This mineral was discovered by Mr. Aplin in a quarry of basalt at Magnet Hill, near Gisborne, where it forms small nodules and mammillary crusts. The fracture of the nodules is flat, conchoidal, sometimes splintery in the centre and earthy outside; and they show, as regards color, an irregular alternation of brownish and greyish-white bands. Nearly one-third of the mineral is soluble in boiling water, and the remainder in sulphuric acid with a slight deposit of silica.—(Mr. Ulrich.)

I have found a good deal of silica in some of the alumstone brought from the goldfields.

SALT.

Up to the present time no beds of salt have been discovered in this colony; but it is probable that the mineral will be found in layers in the Murray basin.

Large quantities of salt are got from the lakes in the Western District.

Mr. Newbery's analyses of concentrated water from four lakes, as given in Mr. Ulrich's notes, are as follows:—

I. St. Mary's Lake (large lake) - - -	contains $\frac{1}{2}$ lb. of salt per gallon of water.
II. St. Mary's Lake, Woolshed - - -	" 1 lb. 2 ozs. " "
III. Lake at Bald Hills, Wynn-Wynn - -	" 1 lb. 7 ozs. " "
IV. Lake at the edge of heath, Mt. Elgin road	" 1 lb. 3 ozs. " "

which gave as closely agreeing results of analyses:—

	I.	II.	III.	IV.
Chloride of sodium - - -	91'89	91'63	92'14	91'74
Chloride of potassium - - -	trace	0'21	trace	trace
Chloride of magnesium - - -	2'14	2'40	2'12	2'36
Sulphate of magnesia - - -	4'98	4'86	4'87	4'91
Sulphate of lime - - -	0'72	0'81	0'76	0'75
Organic matter - - -	0'16	—	0'10	0'23
	99'89	99'91	99'99	99'99

"In II. the organic matter is absent, which probably accounts for the sulphuretted hydrogen and the carbonic acid found in the water, as results of decomposition.

"At Parupa and Williamschase very fine salt is manufactured, which is nearly of the same composition as Liverpool salt, containing in the mean 98'5 per cent. of chloride of sodium, with traces of chlorides of potassium and magnesium and sulphate of lime."

DIAMONDS, SAPPHIRES, ETC.

Diamonds, sapphires, and other gems and precious stones are found on nearly all the goldfields; but up to the present time no gem of great size or extraordinary beauty has been exhibited, though there have been several exhibitions, and one specially of gems and works in the jeweller's art. The latter was initiated by the action of the Reverend J. J. Bleasdale, D.D., F.G.S., who has labored for some years in this branch of mineralogy, and has omitted no opportunity of impressing on the miners the importance of examining with care the gravels and sands resulting from gold washing.

As far as the records made by Mr. Barnard, formerly warden at Beechworth, and Mr. Walter Butler, his successor, extend, about sixty small diamonds have been found in that district. They are generally small, and not very well colored, and in England

would not probably be considered suitable for jeweller's purposes. Mr. Tennant, it is said, has expressed an unfavorable opinion in regard to the value of our diamonds; and if those examined by him were similar to the uncut specimens I have seen, it is not strange that he should have done so.

It is reported that the diamonds which have been got at Beechworth were generally found in or near the ordinary *washdirt*.

They weighed, in most cases, less than a carat; and the largest was two and a-half carats. "The globular form with a rough, crust-like surface, the octahedron, and the trisoctahedron, are common."—(Mr. Ulrich.)

No systematic search has been made for diamonds in this colony. If they occur here as in the Indian Peninsula, they would not be discovered by the ordinary mode of gold washing. It would be necessary to break up the stratum in which they are found, wash it, and make a careful examination of the stuff when dried in the sun.

Mr. W. H. Gaunt, when stationed at Beechworth, reported that as many as fifteen small stones had been got in Mr. Finn's claim on the Woolshed during the year 1865, and surely there a careful search might be made with fair prospects of a profitable result.

Mr. George Foord was, I believe, the first to establish the fact of the occurrence of diamonds in this colony. He examined and reported on one in 1861 or early in 1862. (*Chemical News*, vol. VI., p. 14, July 5th, 1862).*

Small sapphires of a fine blue color are found in the bed of the Tubba Rubba Creek, in the County of Mornington; at the Blue Mountain (Trentham); in the Daylesford and Beechworth Districts, and in the basin of the River Yarra. Corundum, and sapphires of a dull greyish-blue, greenish-blue, and colorless, are common in all the gold drifts. Lately one large deep-blue sapphire, but spoilt by cloudy bands in it, was got at Steiglitz. Many of the well colored sapphires are crystallized; but the larger hexagonal prisms invariably exhibit different bands of color, the base being dark bluish-grey, and gradually shading off towards the top.

As far back as 1853, Mr. George Foord discovered, in a small parcel of specimens brought from Jim Crow diggings (Daylesford District), zircons (well developed crystals), a sapphire—a little barrel-shaped water-worn crystal, blue at each end and milky-white in the central portion,—and a ruby. The latter was a small piece of good color, but with that peculiar milkiness which is frequently observed in the ruby. It was of a flat form as many spinels are, but its characters were otherwise unmistakable.†

* Mr. Foord, in a letter now before me, thus writes respecting some examinations and experiments made by him. "I examined several diamonds; and one or two fragments, of which I obtained possession, I had the pleasure of burning in oxygen. I noticed that some rough diamonds having bright facets have a curious scratched or cracked appearance on the edges, while others have their edges quite perfect. When the diamond is burnt in oxygen gas, it often happens that the last morsel of it falls out of the platinum clip and thus escapes combustion; these residual fragments are of some interest, and appear to promise some information concerning the structure, perhaps even the origin of the diamond itself. One of my fragments falling on to a porcelain tile, and there cooling below the temperature of combustion, was found to have a frosted surface, like that of a water-worn topaz, and to be also pitted all over with little hemispherical cavities. On another occasion the residue falling into water was converted into a perfectly black substance, as hard as diamond, and having a kind of bronze-like superficial tarnish."

† I well remember seeing the sapphire at Mr. Foord's house, some fourteen or fifteen years ago. During a friendly intercourse, extending over a period of sixteen years, Mr. Foord has given help to me. When I exhibited, in 1854, in the Melbourne-Paris Exhibition, a pretty large parcel of gem-

The red corundum has been found also in the gravel of the Mount Eliza Goldfield; and Dr. Bleasdale has in his collection some good star sapphires.

Adamantine spar has been detected by Mr. Ulrich in washed grains in the drifts of the Blue Mountain and Beechworth Districts.

Black corundum is common. According to an analysis made by the Government Analyst, its composition is as follows:—

Silica	-	-	-	-	-	-	-	-	5.35
Alumina	-	-	-	-	-	-	-	-	67.37
Sesquioxyd of iron	-	-	-	-	-	-	-	-	28.04
Magnesia	-	-	-	-	-	-	-	-	0.30
Water	-	-	-	-	-	-	-	-	0.61
									101.67

Fine topazes of large size are found in all the mining districts, and in the islands in Bass's Straits.

I possess a pink topaz, discovered and cut by Mr. Spink, the lapidary; and several large specimens, but only one of remarkable beauty, which is uncut, owing to its being more valuable as a mineral specimen than as a gem.

In the exhibition of gems Dr. Bleasdale catalogued some fine blue topazes.

Almandine, and common red garnet are not uncommon in the Beechworth district.

Rock-crystal, cairngorm, amethyst, carnelian, agate, onyx, opal, semi-opal, opal-jasper, and wood-opal occur in many places with zircon, iserine, tin-ore, &c.

Mrs. Bowman, of Berwick, has collected a good many specimens both of the vitreous and chalcedonic varieties of quartz, as well as gem-stones.

The miners now are anxious to get information respecting the minerals they discover; and the steps lately taken by the Mining Department will, it is hoped, lead to a more careful search for gems and precious stones, and serve to bring to light those which have been discovered and put away as mere curiosities.

stones, &c., procured by Mr. Frank Buchanan in the beds of the Namoi and the Peel, in New South Wales, Mr. Foord examined them and made known the results; thus, as far as I know, being the first to make familiar to the miners the characteristics of the sapphire, &c. Amongst the rather large number of specimens which I exhibited, he found blue and greyish-blue sapphires, zircons, and transparent brown tourmaline.

In another parcel of specimens got some years ago from the gold drifts of the Upper Yarra, in which I had discovered sapphirine and iserine, he found pleonaste.

The aid and advantage I have derived in my blow-pipe examinations from Mr. Foord's experience and skill, really render any discoveries I have made almost as much his as mine.



APPENDICES.



APPENDIX A.

Notes on the Ballaarat Goldfield.

Compiled by MR. HARRIE WOOD, District Mining Registrar, &c.

The first proclamation relating to the goldfields was published on the 16th August, 1851, in a supplement to the *Government Gazette*, No. 16, and relates to alienated as well as to waste lands of the Crown.

20th August, 1851, contains form of license to mine for gold. Fee, 30s. per month. Persons not eligible to obtain license unless they can produce certificate of discharge from last service, or satisfy the Commissioner they are not improperly absent from hired service. Rules adjusting extent and position of land to be covered by license will be regulated by the Commissioner of the locality.

15th October, 1851. Persons known or recognised to have been at a late date in the public service will not be allowed to hold a license, unless satisfactory proof be given that their leaving the service has not only been authorised, but is unattended with embarrassment to the Government.

3rd December, 1851. License fee increased to £3 per month, or £1 10s. for any portion of the month after the 15th day thereof. Tent-keepers, cooks, &c., must hold licenses. This order was rescinded by notice dated 13th December, 1851, the fee to remain the same as under notice 20th August, 1851.

20th October, 1852. Application for lease of land, with description of block, to be addressed to the Chief Commissioner of the Goldfields. After survey of required blocks, notice and description given of the lots open to lease. Leases of lots offered at auction after one month's notice. Leases put up to auction at the office of the Assistant Commissioner of the district; the minimum upset £360 per annum for half an acre, 10 per cent. to be deposited at time of sale, balance in one month; in the event of non-payment of balance, the lease to be forfeited, and to be open to selectors within one month of the date of forfeiture on payment of the highest sum bid, less the deposit paid. Term of lease, one year, renewable on application within one month of termination, and payment of one year's rent in advance; persons resident on leased land to hold license to be issued gratuitously by the Government.

5th April, 1853. Extent of claim, 12 feet square, or 144 square feet per man. Maximum area under lease: alluvial, 160 acres; quartz, half a-mile long by 100 yards on each side.

21st March, 1854 (made by Governor in Council on the 31st December, 1853). Leases of auriferous lands sold at auction to highest bidder (Act 17 Vict., No. 4), extent not exceeding one mile in length of quartz veins, within tracts of auriferous land, which shall have been not less than six months previously proclaimed as open to lease. Extent of claims:—

One miner	-	-	-	12 feet by 12 feet, or 144 square feet
Two miners	-	-	-	12 feet by 24 feet, or 288 square feet
Three miners	-	-	-	18 feet by 24 feet, or 432 square feet
Four miners	-	-	-	24 feet by 24 feet, or 576 square feet

The Commissioner to have power to amalgamate claims on worked or flooded ground. Claims on beds of creeks and water-holes; extent (by grant of Commissioner), ten yards in length by any width.

12th June, 1865. The extent of claims the same as above, except that for prospecting the extent might by special sanction be double or treble that of ordinary claims.

4th October, 1855. Ballaarat Local Court Regulations. Extent of claim for eight men in deep sinking, 34 feet by 34 feet, shaft to be in centre of claim; in all cases shafts to be within 40 feet of each other. Leases for quartz mining, 12 feet by 12 feet for each man employed.

7th March, 1856. Regulations relating to the Frenchman's and White Flat Leads.

8th April, 1856. Regulations relating to the Black Lead.

3rd June, 1856. Regulations relating to the Gravel Pits Lead.

Extent of claim on the above leads, 34 feet in length (with 6 feet of a wall between the claims), irrespective of width until discovery of lead or gutter, and afterwards protection for 40 feet in width.

12th June, 1856. Under these regulations the size of claims was made to depend upon the depth of sinking and the difficulties to be overcome. There were four classes of block claims, the extent for eight men being—class A, 34 feet x 34 feet; class B, 41 feet x 41 feet; class C, 48 feet x 48 feet; class D, 58 feet x 58 feet. (The size of claims, class A, for four men or less, remaining the same as under the regulations of the Governor in Council, published 21st March, 1854.) There were four classes of frontage claims, the extent, after discovery of lead, for eight men, being—class A, 24 feet x 24 feet; class B, 34 feet x 34 feet; class C, 40 feet x 40 feet; class D, 48 feet x 48 feet. Quartz claims—one man, 20 feet; two men, 40 feet; three men, 60 feet; four men, 80 feet along the vein. The regulations relating to frontage leads (7th March, 1856) were the first that provided for the registration of claims. The regulations of the 12th June, 1856, were the first that provided for the registration of block claims.

GOLD DISCOVERY.

Gold was first discovered by Mr. J. W. Esmond, on the 1st July, 1851, at Clunes, on the northern side of the hill, opposite McDonald's (then Cameron's) pre-emptive right. Mr. Esmond started at once for Geelong to make known the discovery, but was delayed on the road in consequence of losing his horse, and did not reach Geelong till the 6th of July, when the discovery was announced.

Hiscock's Gully. About the beginning of August, 1851, gold was discovered by Mr. Hiscock, in a gully near Buninyong, which gully now bears the name of Hiscock's Gully. The gold was first discovered on the surface, and was subsequently traced to a depth of twenty-five feet; but so far as I can ascertain the wash was not rich. A party known as Connor's party, consisting of six persons, namely, Messrs. Connor, Brown, Woodward, Jeanes, Smith, and Thornton, who left Geelong in consequence of the report of Mr. Esmond's discovery, arrived at Hiscock's Gully on the 21st August, 1851, but not being satisfied with the prospects there, left for Clunes, intending to prospect along the route. When they reached the hill, now known as Golden Point, which answered the description said to have been given by some Californian miners, namely, "a hill composed of quartz gravel and boulders," they commenced to search there for gold, and were successful.

On the 28th August, 1851, five parties, of from four to six persons each (amongst the number were Mr. Thomas Bath, Mr. James Oddie, Mr. Francis Herring, and Mr. George Howe), arrived at Buninyong, and thence proceeded to Golden Point, where they arrived on the 1st September, 1851.

From the 1st to the 20th September, 1851, no limit was fixed to the size of claims, each party, consisting of from four to six men, took from a quarter to half an acre of ground; but after the 20th September, the size of claims was fixed by the Commissioner at 8 feet x 8 feet. This rule as to the size of claims appears to have obtained until the extent was fixed by Order in Council.

On the 9th September, 1851, large numbers arrived, principally from Geelong, including ministers of religion, doctors, merchants, and others.

On the 10th September, 1851, Messrs. Esmond, Cavanagh, and about twelve others arrived from Clunes. Messrs. Esmond and Cavanagh marked off a claim, depth of sinking six feet, from which they washed 50 lbs. weight of gold in two days. This was the first gold sent down by escort. The price of gold at this time was only £2 10s. to £2 15s. per ounce. Mr. Cavanagh sent the first parcel of gold to England, through Messrs. Dalgety and Co., where it brought £4 per ounce.

On Friday, the 19th September, 1851, Mr. Commissioner Doveton, Mr. Assistant-Commissioner Armstrong, and Captain Dana, in charge of the black troopers, arrived on Golden Point, and on the next day (the 20th) the first goldfields licenses were issued (Connor's party taking the first six), at the rate of 15s. each for the remaining part of that month.

As the numbers increased so as to occupy the whole of the hill (Golden Point), parties, acting upon the information that hills with quartz gravel and quartz boulders on the surface were the most likely to prove auriferous, appear to have spread out on the one hand along the Golden Point and White Horse Range, and on the other hand along the Black Hill Range, towards Little Bendigo, to prospect for gold; and as the result of their prospecting operations, the surfacing at the heads of the several gullies from which the leads took their rise respectively was discovered.

Golden Point.—Gold was first discovered here on the 25th August, 1851, by Mr. F. Brown, of Connor's party; and on the 27th of that month the first cradle was used for washing purposes, and 4½ ozs. of gold was obtained as the result of two hours' washing. The cradle was made by the party from a description published in the newspapers of those used in California. Connor's party continued working till the 2nd October, 1851, a period of between five and six weeks, and during that time they obtained 340 ozs. of gold. The gold was, in the first instance, obtained from the surface, and was followed to a depth of eight feet; the bottom was pipe-clay, over which

was a layer of light green clay, very tenacious, and thickly studded with gold. Higher up the hill, a stratum of red conglomerate was found overlying the green clay, which was in places very rich, as much as 14 lbs. weight having been washed from a tin dishful of the dirt. The thickness of washdirt in the deeper claims varied from two to five feet, but in some of the shallow claims the whole of the earth, from the surface to the bottom, was taken out and washed. This latter mode of working was termed "paddocking." Where shafts were sunk they were mostly round or oval, the washdirt was taken off the bottom of the shaft, and from the sides as far as could be reached from the shaft by means of a pick and shovel, but no drives were at first put in. After a time single drives were cut in different directions from the shaft, leaving the blocks of earth between the drives (called "pillars") as supports, there being no timber supports used; thus only a small portion of the claim was, in the earliest days, worked out by the first parties. In many instances the layer of cement, when met with in sinking, was mistaken for bottom, or was looked upon as a substance not to be sunk through, and the claims were abandoned. Many of these shafts were subsequently taken possession of by other parties, but in consequence of the earth about the upper part of the shaft being unsound, it was found necessary to support it by some means. Mr. Beilby, about the end of the year 1852, conceived the idea of employing saplings for this purpose, and he procured a quantity (about four inches in diameter) from the neighboring hills, cut them into lengths to suit the size of the shaft, fitted the ends and sides together by means of grooves or notches, and placed them in the shaft much in the same manner as slabs are now used in shallow workings. The depth of sinking at this part of the hill was about twenty-five feet, and wet. Having secured the top of the shaft, they attempted to sink through the cement by means of hammer and gads, but were not able to make much progress, in consequence of the hardness of the cement and the quantity of water, and having nothing but a nail-can to bale with, they were compelled at length to abandon it. In January, 1853, a shaft near the head of the Red Streak Lead was slabbed with sheets of bark placed perpendicularly against the sides of the shaft, and fixed in position by means of sapling frames. In March, 1853, a party commenced sinking at the foot of the Golden Point, towards the Gravel Pits Flat, and used split slabs as supports; these were the first split slabs used; they sunk through the cement by means of blasting, which operation was at that time regarded as a great novelty. About this date the first engine arrived, and was erected at the foot of Golden Point, for the purpose of washing everything on a face to the depth of twelve or fourteen feet, by means of sluice and cradle; but the enterprize was abandoned after a short trial, and the engine removed.

White Flat.—The White Flat was opened in April or May, 1853, below the point on which the gaol now stands; the sinking was from ten feet to sixteen feet, with white gravel washdirt and pipeclay bottom. There was a great deal of water, but the wash was rich, the claims yielding from £400 to £500 per man; most of these claims were worked by windlass, but some, especially the "paddocks," by the lever whip.

Canadian Gully.—On the 20th September, 1851, prospecting commenced at the head of this gully, and coarse nuggety gold was found in the surface; but the gully was almost entirely abandoned towards the latter end of October, in consequence of a rush to Forest Creek, and it was not taken up again till about July, 1852, when a few parties commenced, and continued working at the head of the gully till the latter part of January or beginning of February, 1853. About this date the numbers increased, and the wash was followed down to a depth of fifty feet, at which depth, in the month

of March of that year, the large nugget, weight 136 lbs., was found. In this part of the gully the wash was rich, yielding on an average about 35 lbs. weight of gold to the claim (eight feet by eight feet). The wash, or lead, was traced into the flat, where for a short distance it was comparatively poor; but towards the point at which it was joined by the Prince Regent and other leads it was very rich, the yields varying from £1,000 to £2,000 per man; but in scarcely any instance was a claim worked out by the first party, large blocks of ground being left between the drives for supports. Up to this point the drives do not appear to have been timbered, except by a single prop or leg, with a flat piece of wood on the top as a "cap." The washdirt on this lead near the brow of the hill was brown and white clay-gravel, with sandstone slate and quartz boulders, and the bottom chiefly pipeclay. A little water was found in the drift in sinking (August, 1853), but upon the flat towards the junction of this and the Prince Regent Lead, a drift from the surface to a depth of ten or twelve feet was found, containing a large quantity of water. In sinking through this drift three or four men were kept continually baling with buckets, and even then the water was with difficulty kept down. In this place puddle-clay appears to have been first used for stopping back the water; the plan adopted was to cut the drift away much larger than the proposed size of the shaft, and then to put in slabs the size of the shaft, and to throw in and ram the puddle-clay behind the slabs; but in sinking deeper a second drift was met with, also containing a large quantity of water, which could not be sunk through and puddled in the same manner as the surface drift, owing to the impossibility of keeping the sand back while sinking through and putting in the puddle-clay; in this difficulty the following plan was suggested and acted upon. Four slabs, somewhat less than the size of the shaft, were fastened together, and placed in the centre of the shaft, and driven down as far as possible into the drift; the slabs were then taken out of the solid ground above the drift, and the walls of the shaft cut away some foot or more into the country, and long slabs were fitted in. This process was termed "opening out." The shaft was then cut down of the increased size and slabbed, the box in the centre being always kept below the lowest set of slabs, and the drift between the box and the sides of the shaft not being removed except so far as to make room for the slabs until the set had been placed in position and made fast; the drift between the box and the slabs was then taken out, the box in the centre lowered, and the same process followed with each set of slabs until they got through the drift into solid ground. They then commenced from the bottom to slab up with slabs the size of the shaft, and as each set was put in puddle-clay was filled in behind and rammed, the long slabs called "drift slabs" keeping back the drift. When completed the shaft was the same size all the way down, and there was a puddle wall between the double sets of slabs extending a foot or more above, and a foot or more below the drift; this in most cases effectually stopped back the water, but in some cases the water forced a passage through the puddle, and they then had recourse to caulking the seams between the sets of slabs. The slabs used on this lead were split, and those first used were notched at the ends, and thus fitted together in sets; but this mode of fitting the slabs together was not found suitable in wet ground, and the plan of boring holes in the ends of the side slabs with an auger, and driving pegs to keep the end slabs in position, was adopted. In the claim at the junction of the Canadian and Prince Regent Leads (known as the Blacksmith's Hole), the washdirt was very rich, and there was a great thickness of it. The blacksmith's party obtained over £3,000 per man (eight men); but large quantities of gold were taken by the holders of the adjoining claims, who drove upon them (one party drove right into the blacksmith's shaft). The average yield from this claim was about 1 oz. to the

American bucket, but as much as 50 lbs. weight of gold was washed from one tub. This claim was afterwards worked a second and third time, and handsome yields obtained on each occasion; it has since been worked by Chinese. The quantity of gold taken from this claim has been estimated by reliable men at a ton weight. The average thickness of the washdirt in the claims on the flat was four feet; it was a greenish color, composed of sandstone and quartz boulders, mixed with loose clay-gravel; the reef was in some places a kind of sandstone, in others pipeclay. The claims were worked by means of the windlass; those first used were made entirely of wood, but about August or September, 1853, the iron handles fitted into wooden barrels were introduced, and were a great improvement, on account of the ease with which they were worked as compared with those made wholly of wood.

Prince Regent Gully.—This gully was opened at the shallow end about February, 1853, and very rich ground was found; but when the wash reached a depth of sixty feet or seventy feet it was not so rich, some of the claims did not yield more than 3 lbs. weight of gold per man; but, owing to the character of the washdirt, it is supposed a large proportion of the gold was left by the first parties in the claims. The upper portion of the washdirt was a stiff brown and white clay with quartz gravel and quartz and sandstone boulders intermixed, but the lower part was brown cement lying on and frequently embedded in a hard sandstone reef; this was so hard in places that in chipping it up to get the gold fire would fly from the point of the pick. There was very little water in the drift up the gully, but when the lead was traced into the flat the quantity of water increased considerably, and the character of the washdirt and reef was entirely different. On the flat towards the junction of this with the Canadian Lead about two and a half feet of black clay was met with in sinking, immediately below it was about two feet of sand, and then came about four feet of washdirt similar in color and character to that in the Canadian Lead, towards the junction. In consequence of the sand over the washdirt it was found difficult to keep up the roof of the drives, and therefore the miners had recourse to what was termed "boxing" (i.e., slabbing the drives much in the same manner as the shafts), but this was found to be a very slow process; and as there was usually more or less spare ground left between the claims, and this spare ground was considered the property of the party or parties who could first work it out or "fence it in" (i.e., surround it by a drive or drives), some parties hit upon the plan of driving through the sand, leaving the black clay for a roof, which would stand with little or no timber, and the washdirt under the drives; and by this means they were enabled to reach the limits of their claim and secure the spare ground long before their neighbors. About this place, in the month of September, 1853, they began to use "sets of timber" (i.e., legs and caps) fitted together by means of grooves in the cap-piece and shoulders in the legs. This lead towards the junction was so rich that the claims were styled jewellers' shops, the average yields obtained by the first parties being from £1,600 to £2,000 per man, the usual number of men in each claim being eight. The depth of sinking at the junction of the Canadian and Prince Regent Leads was 110 feet.

Sailor's Gully.—This gully was opened in February, 1853, shortly after the Prince Regent Gully. The shallow ground was first worked, and some portions of it were very rich. The lead was traced into the flat, where the sinking resembled that at the deeper end of the Prince Regent Lead; here a drift was met with containing a large quantity of water, with a stratum of black clay overlying the washdirt. The reef was generally pipeclay, but in some places sandstone reef was found, and it was remarked that the lead was found much poorer where the sandstone bottom occurred.

Between the black clay and the bottom was between five and six feet of gravel, the whole of which was usually taken as washdirt, so that the black clay should form the roof of the drives, thereby saving expense and trouble in timbering. The average yields from this lead along the flat till it joined the Prince Regent Lead were from £500 to £600 per man. The depth of sinking at the junction of this with the Prince Regent Lead was about 100 feet. The mode of working was in every respect similar to that on the Canadian and Prince Regent Leads. In 1856, the shallow ground at the head of this gully was traced across the top of the range and down the other side in the direction of the Woolshed and Miner's-right Leads. The wash was not very rich, and was of a stiff light yellow and blue clay, very greasy and difficult to puddle, and containing very little quartz.

Scotchman's Gully.—This gully was opened in 1853, some time after Sailor's Gully, about the month of November; the upper part of the gully was dry sinking, chiefly through clay, and the shafts were mostly oval or round without slabs until the lead reached a depth of forty feet. The washdirt at the shallow end was tough brownish clay with very little gravel. Some of the claims paid very well. When the lead was traced to a greater depth, slabs were used in sinking. The gutter at the deeper end of the lead was about sixty feet wide, the washdirt about three feet thick, a dark-colored loose gravel; and the bottom on one side of the gutter was blue slate, on the other, sandstone. At this part of the lead there was a wide wash on the reef, chiefly red cement and quartz gravel; the yields varied from £150 to £350 per man. This lead was traced into the lead from Newchum and One-eye Gullies, and thence to its junction with the Sailor's Gully Lead.

Newchum Gully.—This gully was opened at the end of 1853 or very early in 1854, but I have not been able to obtain any reliable information respecting it, beyond the fact that it was traced into the lead from One-eye Gully, and so to the Scotchman's Lead.

One-eye Gully.—This gully was opened about September, 1855, but was very wet and poor. It was rushed in consequence of a report that a large quantity of gold had been discovered in a prospecting claim and as a publican in the gully was principally interested in the prospecting claim, he was supposed to have circulated the report for the purpose of creating a rush about his house; and a large body of miners, disappointed at the result of their labors, assembled with the intention of destroying his house, but were prevented from doing so. The lead was afterwards traced down till it joined the lead from Newchum Gully, thus making the line of gutter complete from the One-eye Gully to the foot of the Canadian. From the One-eye Gully, a lead, styled the Victoria Lead, was traced a short distance in the direction of Buninyong, but it was very wet and poor, and the sinking very difficult in consequence of being through drift almost from the surface to the bottom.

The Red Hill Lead.—The shallow ground from which this lead was traced was opened at the end of 1852, between Poverty Point and Canadian Gully, on the eastern side of the Golden Point Range. The sinking was chiefly through a stiff red clay, and the washdirt was red-colored clay and gravel; the gold was coarse, and some of the claims at the shallow end paid very well; and they were worked in the same manner as the claims on the Canadian and Prince Regent Leads. Beyond the point at which this lead joined, or was joined by, the Canadian and other leads the sinking was very difficult in consequence of the drifts, which were very fine, and the great quantity of water. Some parties were nine months in sinking their shafts. The same mode of double slabbing and puddling through the drift as upon the Canadian Lead was adopted

on this lead; but in cases of leakage from the drift-water forcing a passage through the puddle-clay, it was stopped by means of plugging instead of caulking as hitherto: the plugging was managed as follows. Holes were bored through the slabs by means of an auger, plugs of puddle-clay were prepared and rolled to the size of the holes so bored, and these plugs of clay were forced through by means of a rammer until it was impossible to force in any more, or until the leak was stopped. It was noticed by several parties on this lead, while sinking through the drift at Red Hill, that when the parties sinking on the Gravel Pits Lead at Gravel Pits Flat (a distance of about half a mile) stopped baling, the water in the drift at Red Hill increased very considerably, and the influx or pressure of the water was always from the dip to the rise of the lead (i.e., from the deep end towards the shallow end). Some of the claims at and beyond the junction of this lead with the Canadian Lead were very rich. From one claim, twelve feet by twelve feet, over 125 lbs. of gold was taken; and from several of the other claims larger yields were obtained. The washdirt was very dark-colored quartz-gravel, varying in depth from three to six feet, the bottom chiefly green slate, and there was a great quantity of water in the bottom. The lead continued rich through the Red Hill, but as it approached the point at which it joined the Eureka Lead it was comparatively poor. The washdirt at the junction was about three feet thick, and contained from 2 to 6 dwts. of gold to the tub of dirt; this was not considered "payable" at that time (May, 1855), and very little of the claim was worked; but the ground was taken up and worked by two companies, known respectively as the John Bull and the Cumberland Companies, about two years afterwards, and they discovered a wash on the reef similar in character to the Gum-tree Flat wash, and equally rich. The point of junction of these leads was at the rear of the Royal Mail Hotel, situated at the corner of Eureka-street and the Main-street, and the depth at the junction was 140 feet.

Black Hill.—Surfacing was discovered here early in October, 1851; but there being no water on the hill the dirt had to be filled into bags and rolled or carried down the side of the hill, and washed at the Yarrowee Creek. A small bag of dirt, such as a man could carry down on his back, appears to have yielded about 2 or 3 dwts. of gold. Early in 1853 a party of Frenchmen opened a very rich quartz vein on this hill; they had no crushing apparatus, but simply broke up the quartz with hammers and picked out the gold. The quantity of gold obtained by them cannot now be ascertained, but they stated to my informant that they had made sufficient and intended returning to France. About April, 1853, a Mr. Otway erected a windmill on the top of the hill to supply motive-power for a crushing apparatus, consisting of four wooden beetles, shod with iron $1\frac{1}{2}$ inch thick; but it did not answer for the purpose of crushing quartz. There are several gullies running down from this hill; the richest of them, situate on the north-eastern face of the hill, was named Two-ton Gully, from the general supposition that two tons of gold had been taken from it. The sinking was through fine red cemented gravel, dry; and the nature of the washdirt was red and white gravel, water-worn, and presenting very much the appearance of the bed of a creek or stream; the bottom was pipeclay, and the gold very coarse. From this gully the Bakery Hill Lead takes its rise. The Mopoke and Black Hill Gullies are on the opposite side of this hill, and feed the Mopoke and Black Hill Leads.

Little Bendigo.—Towards the end of 1851 gold was found in several gullies; but I have not been able to obtain any reliable information respecting the dates, yields, &c.

Brown Hill.—Gold was found here on the surface about the 15th September, 1851, and on the 25th of that month the commissioners first visited the locality for the

purpose of issuing licenses. I have not yet been able to obtain any definite information as to the yields, &c., &c., in the particular gullies.

The Eureka Lead.—This lead was opened in July, 1852, at Little Bendigo, at a depth of four feet, of which two feet, consisting of clay, gravel, and large quartz boulders, was taken as washdirt. There was no water, and the washdirt was carried in bags to the creek and washed in tubs. The yields varied from 1 oz. to 1 lb. weight of gold to the tub. (October, 1852.) The lead was traced into and through a hill then known as Sinclair's Hill, where, owing to the dip of the lead and the rise of the surface, the depth of sinking reached fifty feet. The earth was raised by means of a windlass, and was washed in tubs. The claims were usually worked by parties of four men. (December, 1852.) Thence the lead was traced through Rotten Gully, where the washdirt was very rich, the claims paying on an average £600 per man. The ground was a little wet and very rotten, consequently slabs had to be used in sinking to support the shafts. Notwithstanding the richness of the wash, a great deal of the ground was left unworked through inexperience in driving and timbering. The depth of the lead in this gully was nearly seventy feet. The lead was narrow and the reef steep and well defined, and the whole of the ground between the reefs has since been taken out. The lead was traced into the flat at the foot of the gully and was there lost, and as soon as the claims on the gutter had been worked out the lead was abandoned. At the end of about eight months from that time several parties started to prospect for it on the flat, and at length discovered it at a depth of about twenty feet (the difference between the depth here and in Rotten Gully is accounted for by the difference in the surface levels); but it was not so rich on the flat as it was nearer the source. The lead was traced across the flat to the Yarrowee Creek. The lead in the flat was very wide, in some parts between 200 and 300 feet, and the average yields were from $\frac{1}{2}$ oz. to 2 ozs. to the tub. The lead near the creek was very wet, the quantity of water being about 200 gallons per hour. The water was raised by windlass and one sixteen-gallon bucket. On the eastern side of the creek the surface rises, and the lead traced through the rising ground reached a depth of from forty to fifty feet. A wet drift was met with in sinking here at about ten feet from the bottom, and large sandstone boulders were found overlying the washdirt, which at this point was from three to four feet in thickness, and very rich. Some claims averaged 8 ozs. to the tub, the gutter having narrowed to about six feet in width with well-defined reefs. Near to, but above the point at which the Native Youth Lead joined this lead, a nugget weighing 356 ozs. was found by Chisholm and party. The bottom here was green slate, which had not been previously met with on this lead. The depth of sinking at the junction of this and the Native Youth Leads was seventy feet. At and below this junction several large nuggets were found in the claim of Smith and party, varying from 2 lbs. to 5 lbs. weight. Up to about this point on the lead the practice had been to wash the dirt as it was raised (the tub and cradle being used for that purpose); but the parties now commenced to stack it in what was termed paddocks (*i.e.*, a space alongside the shaft fenced in with slabs), until the claim had been driven out, and then they had a general washing up. About the point at which the Caledonian Lead was afterwards discovered as much as 300 ozs. of gold was washed from one tub of dirt by Sim and party. The depth of the lead at this point was about 120 feet, and thence to the Grave-yard Hill, where it reached the depth of 150 feet, the yields were very good. Between the last-mentioned points the gutter and reef taken together paid about six claims wide. At the Grave-yard Hill there were some rich claims, which gave £1,000

per man (eight men to the claim); but the "payable" ground was only about three claims wide. The lead was traced from the Grave-yard Hill past Pennyweight Flat to the back of the Royal Mail Hotel, where it joined the Red Hill Lead. Between the points last-mentioned this lead was not so rich, and the quantity of water increased considerably towards the junction. A very bad drift had to be sunk through. Some parties were baling with eighteen-gallon wooden buckets and with bullock-hide buckets from six to eight months before they could reach the bottom. The drifts on this lead were puddled in the same manner as on the Canadian and Red Hill Leads, and the shafts and drives were similarly timbered. At Pennyweight Flat, lying between the Eureka and Red Hill Leads, was a wide reef-wash at a depth of about sixty feet. The washdirt was very rich; but during the heavy flood in November, 1855, the time at which this flat was being worked, the bulk of the washdirt which had been stacked in paddocks was washed away and the gold lost to the owners of the claims.

The Native Youth Lead.—This lead was discovered about the month of June or July, 1858, on the Black Hill Flat, at a depth of fifteen feet. The sinking was through clay, gravel, and cement, quite dry. The washdirt was very hard clay intermixed with quartz. The gold was generally large. One nugget, 45 lbs. weight, and several smaller ones, were found. This lead was traced into the Eureka Lead at a depth of about seventy feet.

Caledonian Lead.—This lead was discovered in June, 1856, from old workings on the Eureka Lead (*i.e.*, by a party of miners while working the old ground on the Eureka Lead), at a depth of about 120 feet. The sinking upon this lead was chiefly through a light-colored clay and a wet fine drift. The washdirt was a fine gravel-wash and very rich. The claim taken by the discoverers, styled the "prospecting claim," yielded £34,000 to a party of eight men. The lead was proclaimed a frontage lead, and the miners on the lead having the privilege of electing their own surveyor for the lead, chose the late Mr. Wingate, who laid off a large number of claims on the supposed course. Under the regulations then in force relating to frontage leads the holders of a frontage claim were entitled to only a certain number of feet along a lead, consequently, owing to the sinuosities of the lead, the space laid off on the surface as a claim would in most cases include a greater length of the lead than under the regulations was allowed to one claim; when such was found to be the case, the prescribed length of the lead was laid off under ground, and the extra length of lead became spare ground, and was, on account of its richness, usually the subject of a dispute if not of a fight. The lead was traced a considerable distance towards Brown Hill, and the claims were generally good. The average yield of the claims has been estimated by experienced men at from £200 to £500 per man. The time usually occupied in working out a claim on this lead was about two months.

Lady Barkly Lead.—This lead was discovered in the month of July, 1856, by a party of miners working near the junction of the Eureka and Caledonian Leads, at a depth of about 120 feet. It was proclaimed a frontage lead, and a large number of claims were taken up on it; but only about thirty of the claims were worked, as the lead was not rich.

Ashe's Lead.—This lead was discovered about the month of June, 1855, at Pennyweight Gully, and was traced down into the Eureka Lead. Several of the claims paid very well; one towards the junction gave over £400 per man.

Esmond's Lead.—This lead was discovered by Mr. Esmond and party, about August, 1856, while working the old ground on the Eureka Lead. It was proclaimed a frontage lead, and a number of claims were taken up, but only about twenty of them

were worked. Esmond and party obtained over £500 per man from their claim ; and some of the other claims paid moderately well.

Black Hill Lead.—This lead was traced from the Two-ton Gully, on the Black Hill. It was worked during the year 1854, but I could not ascertain the exact date on which it was opened, nor could I obtain any reliable information respecting the nature of the sinking, washdirt, &c., &c. It was traced into the Eureka Lead, at Grave-yard Hill.

Gravel Pits Lead.—The shallow ground from which this lead was traced was opened about the month of June, 1853, and was near the junction of Princes-street and the Melbourne-road. The shallow ground was gravel from the surface to the bottom, and was worked by means of paddocks, hence the name "Gravel Pits." As the lead was traced down its course a drift, containing a great quantity of water, was met with. In a shaft near the present site of St. Paul's Church it was found impossible to sink through the drift without puddling ; the miners therefore increased the size of the shaft (termed "opening out") a little above the drift, made a frame nearly the same length and breadth as the shaft where opened out, placed it in the shaft, and drove slabs pointed at one end behind this frame as far as possible into the drift ; they then sank in the drift—always keeping the points of the slabs driven into the drift below where they were sinking. When deep enough, they put in another frame to support the lower ends of the slabs, and the next set of slabs were then driven down between the second frame and the points (lower ends) of the first set of slabs, and so on, until they reached the solid ground below the drift. This mode of getting through a drift was termed "piling ;" the slabs driven down behind frames were termed "piles." Sometimes in sinking through a drift in this manner a box was driven down in the centre of the shaft, which helped to support the points of the slabs, and keep them from being forced by the pressure of the drift into the shaft. The greatest difficulty was sometimes experienced in keeping the frames in position, because the pressure from the drift was not always equal on all sides, and consequently the frames and piles were carried out of plumb ; and sometimes—in spite of every precaution—the drift from one side or other would burst into the shaft ; and as fast as this was removed to enable them to make good the timbering, more would run in, so that a large cavity on one side would be made, and the pressure against the frames being unequal, would, in some cases, twist the frames half-way round. Sometimes—in spite of the twist—they were able, by filling up the cavity with bark, clay, and other materials, to continue sinking until they reached the solid ground below the drift ; and then, having to some extent drained the water from the drift, they could, before puddling up so far, repair the shaft so as to be able to slab and puddle up in such a manner that the shaft would be plumb when complete ; but in other cases, where the running in of the drift could not be stopped, or damage done to the timbering repaired, they had to fill up the shaft with earth, level with the top of the drift, and then sink down again, taking out the old timber where necessary as they went down. When the solid ground below the drift was reached, they slabbed and puddled up in the same manner as described under the head of Canadian and Red Hill Leads. In consequence of the great quantity of water in the drift the parties were prevented from sinking their shafts on the Gravel Pits Flat, until Messrs. Talbot, Emery, and others erected a small engine, a little south-east of the site on which the North Grant Hotel now stands (this engine was one of the first employed on this goldfield), for the purpose of drawing the water out of their own shaft. Through the means of this engine the parties higher up the lead were enabled to sink their

shafts; but great opposition was shown by some of the miners to the erection of this engine, as it was supposed by them that the introduction of machinery would injure the working classes. A body of men proceeded to the claim for the purpose of smashing the engine, but were prevented from doing so by Mr. Talbot, one of the proprietors, who had provided himself with firearms, and threatened to shoot the first man who approached. One of the richest claims on this lead, known as the Italians' Claim, gave £2,000 per man to the first party, for seven weeks' work after bottoming. It was then sold to a party of sixteen men, who obtained, in the course of five weeks, nearly as much gold as the first party had taken out; and it was afterwards worked by a third party, who were well paid. Several of the claims on that portion of the lead were very rich. The washdirt on the main lead was a dark-blue or black gravel on a green slate bottom; but there was another run or lead (called the White Gutter) alongside, but not so deep, and the washdirt was much lighter in color. This White Gutter was then supposed by some persons to have been the original water-course, and the main lead or gutter to have been formed by the stream having been diverted by some means from its original course, and cut another and deeper channel. By others it was regarded as a reef-wash. The depth of this lead, when it reached the flat, was about 140 feet. This lead was joined by the lead formed by the junction of the Red Hill, Eureka, and Red Streak Leads, a little to the south of the site now occupied by the Blue Jacket Hotel, on the Main-street, and it was joined by the Bakery Hill Lead, near the corner of Peel-street and Main-street; it was then traced along the flat to the foot of the Camp Hill. Up to that point it was held under block claims, but it was then, in the month of June, 1856, proclaimed a frontage lead, and several claims were registered; but only one company, styled the Old Gravel Pits Company, worked it under the frontage system, as it joined the Golden Point Lead near the site now occupied by the Wesleyan school-house, at the corner of Lydiard and Dana streets.

Black Hill Flat.—This was opened early in 1853, and some rich patches of ground were discovered; the depth of sinking was from about six to twelve feet; the washdirt gravel about two feet thick, upon a pipeclay bottom; and the gold was coarse. The ground was worked chiefly from "paddocks." The "Nil Desperandum" nugget, weighing about 500 ozs., was found on this flat.

Bakery Hill Lead.—This lead was traced from the workings on the Black Hill Flat in 1854, and was joined by a lead from the Mopoke and Black Hill Gullies; it was traced through Bakery Hill, near the site now occupied by the Eastern Railway Station, and down into the Gravel Pits Flat, where it joined the Gravel Pits Lead, near the corner of Peel and Main streets. This lead was narrow, between steep reefs, and not very rich; the washdirt was about six feet in height, a dark gravel with a great number of large slate and sandstone boulders. The gold was large, but with the exception of some nuggets, the largest of which weighed 30 lbs., no very rich ground was discovered during the first working, the average yield being about 1 lb. weight of gold to the lineal foot of the lead by the whole width of the gutter, which did not exceed forty feet. Portions of the lead were worked a second time; and on the 9th June, 1858, a party of miners working that portion of the lead on the eastern side of Humffray-street, between the Eastern Railway Station and Wills-street, discovered the "Welcome" nugget, weight 2,217 ozs. 16 dwts., upon the reef.

Red Streak Lead.—This lead was opened about March, 1855, on the side of the Post Office Hill, near the present site of the Chinese encampment, and was traced into the flat at the rear of the John o'Groat Hotel, where it joined the lead formed by the

junction of the Eureka and Red Hill Leads. The lead formed by the junction of these three leads was traced through the Gum-tree Flat, to its junction with the Gravel Pits Lead at the rear of the Blue Jacket Hotel. The depth at which this lead was opened was about thirty feet; and on the flat the depth was from 120 feet to 150 feet; the washdirt was a loose dark-colored gravel intermixed with black conglomerate and sandstone boulders, the height of washdirt being from four to six feet. As a rule the claims on the gutter were not so rich as those on the reef. Several of the reef claims gave from £400 to £500 per man. In sinking, a bad drift with a great quantity of water was met with. In consequence of the difficulty of sinking through this drift by the ordinary method, a party of blacksmiths conceived the idea of employing sheet-iron instead of slabs for supports. The sheet-iron was formed into large cylinders, the size of the shaft; they cut down the shaft to the proper size and let down the cylinders one above the other, intending when they reached the drift to force the cylinders into the drift in advance of the sinking, and they reckoned that by keeping the cylinders well driven down below the point at which they were sinking they would prevent the drift from running into the shaft. The cylinders answered very well in sinking through the solid ground so long as they had sufficient play, but when the clay began to swell they became fixed and could not be forced down. The party then prepared cylinders of less diameter and let them down inside of those that had become stationary, and thus they were able to reach a depth of about thirty feet; but they found that where great pressure came against the sheet-iron it buckled; they also found that wrought-iron would not stand the pressure necessary to force it through a drift, and therefore they abandoned the shaft. Most of the claims were worked by the windlass, but in some cases whims worked by horses were employed. The washdirt was stacked in paddocks till the claims were worked out, and then it was washed up in tubs and cradle.

Gum-tree Flat.—About the end of 1854 or beginning of 1855 a windmill was erected on this flat for the purpose of working a boring machine (a kind of auger), to bore for the junction of the Red Hill and Eureka Leads; but before any great depth had been reached the undertaking was abandoned as a failure. This flat was opened about July, 1855, and was a very wide reef-wash and very rich. The depth of sinking varied from 130 feet to 145 feet, chiefly through black clay and rough quartz drift; and a layer of basaltic rock about two feet thick was met with at the western end of the flat. The washdirt near the gutter was dark blue or black gravel containing a large quantity of decomposed wood, but the wash farther from the gutter was light brown clay mixed with gravel. One party of six men obtained 112 lbs. weight of gold as the result of ten weeks' work. Belcher and party (eight men) divided £3,000 per man for four months' work. A party of eight Frenchmen divided £2,500 per man for five months' work. A party styled the "Hell Fling Mob" divided £2,500 per man. A party known as the "Sanctified Mob" divided £1,500 per man. The claims were worked by windlass or whim, and there was one steam engine employed at the western end of the flat. Some of the windlasses were made on an improved principle, the axle working upon brass rollers fitted into an iron box, and the box was let into the windlass stand, and a fly wheel was fitted on to the axle. The rate of wages during the time this flat was being worked was very high, namely £1 per shift for ordinary miners, and 30s. per shift for good underground miners.

Golden Point Lead.—This lead was discovered in April or May, 1856, at the foot of Golden Point, between the site now occupied by the gas works and the White Flat Bridge, at a depth of about sixty feet, and was proclaimed a frontage lead.

The first claims were registered in the month of May, 1856. The lead was traced across the White Flat, into the hill immediately below the Wesleyan school-house, where it joined the Gravel Pits Lead.

THE LEADS UNDER THE BASALTIC TABLE-LAND.

The miners, finding that the width of the "payable ground" along the leads was very limited, seldom exceeding three or four claims, and frequently not exceeding the width of one claim; and also finding that, owing to the sinuosities of the leads, the point in advance of that where it was being worked at which the lead would be found could not, before sinking, be ascertained, nor even guessed at with any accuracy, and that, consequently, a very large amount of money and labor was expended in sinking shafts which were useless on account of their not being within reach of the "payable ground," had recourse to shepherding. The practice of shepherding was as follows. Claims were marked out in advance of the point at which the lead was then being worked, and in every direction in which it was thought the lead might trend, and a shaft was commenced on each of these claims; one or two would then attend daily during certain hours at each of these claims, and throw out one or two shovelfulls of earth, and then leave the pick and shovel in the shaft until evening, when the men, commonly designated "gentle shepherds," would take the tools away, and retire for the night, the same form being gone through each day until the lead had been traced to within a moderate distance of the claim, or until it had been found to be trending in a different direction, when the sinking of the shaft would be proceeded with or the claim abandoned, as the case might be. During the shepherding process the shaft would seldom be sunk more than a few feet, though it had been shepherded for months; but sometimes, especially where there was any surface water, they would erect a windlass and bale out the surface water each day, instead of sinking the shaft; in such cases the shepherds would bring a rope and bucket to the claim instead of a pick and shovel, and after baling out the water, would leave the rope and bucket on the windlass till evening, when they would take them away for the night. By this means one man was able to hold possession for months of a claim for eight men, and in some cases one man would hold several such claims by doing a little work in each of them daily; but if it were known that one man was shepherding more than one claim, the claims were deemed "jumpable." It was not an uncommon practice amongst the shepherds to sell shares in their claims when the prospects (i.e., probability of the lead trending into it) rendered the shares valuable. The evils of shepherding were not fully realized until the leads were traced into the table-land, where, the depth of the leads having greatly increased, and the sinking through rock and drift containing a great quantity of water being both difficult and expensive, those who sank shafts might be ruined, and those who were shepherding might profit by their ruin. For example, one party would start and sink a shaft upon their claim, the ground on either side being held by shepherds; this party might "bottom" on the reef so far from the gutter, that no portion of it would be in their claim; thus all their labor and money would have been expended to no purpose, except, perhaps, from the dip of the reef, to indicate which of the surrounding claims would be most likely to have the lead, and the person who had been shepherding that claim would reap the fruit of their industry. One of the first acts of the Ballaarat Local Court was to abolish shepherding; but this did not meet all the requirements of the case, because, if all the parties who took up claims were compelled to sink shafts, there would, in many cases, be twenty shafts sunk for every one that would be within reach of the lead; thus numbers would have been ruined by being forced to sink useless

shafts. Towards the end of the year 1855, or beginning of 1856, a Mr. Bacon suggested a scheme by which he proposed to secure to each party sinking a shaft a certain portion of gutter. The scheme was regarded by a large body of the miners as an attempt at monopoly, and it was vehemently opposed; but subsequently it was taken up by Mr. James Baker, and, under the style of the "Frontage System," was introduced and adopted by the local court.—(*Gazette*, No. 24, March 7th, 1856.) Regulations known as "Frontage Regulations" were framed by the local court, the first of which were framed especially for the Frenchman's Lead. A lead to which frontage regulations were applicable was termed a "frontage lead," and a claim upon a frontage lead under frontage regulations was termed a "frontage claim." Under the "frontage system" an official survey of the claim, and registration of the names, &c., of the holders was obviously necessary; consequently, upon the recommendation of the local court, an officer was appointed to make survey and registration of claims upon each of the frontage leads. These officers were styled mining surveyors, and Mr. John Wall, of Sebastopol, was the first mining surveyor appointed in this district. A frontage claim in the early days was in effect an underground block claim upon a certain lead or gutter, the precise locality of which claim was not fixed until the holders of the claim had discovered the position of that portion of the lead or gutter which would lie within or be included in or covered by such claim; and for the purpose of searching or prospecting for such lead, or rather portion of lead, they were allowed protection over the ground lying between two given lines marked on the surface for the purpose of fixing the length of the claim, leaving the lateral boundaries undefined until the lead or portion of lead to which the holders of the claim were entitled had been discovered. It was the duty of the holders of a frontage claim, as soon as they had discovered the lead, to cut a drive along its course throughout the claim, so that the surveyor might fix the lateral boundaries of such claim, and it was the duty of the surveyor to watch the progress of the drives along the course of the gutter, and to indicate its position by posts or flags placed on the surface immediately above the point to which the gutter had been traced. The use of these flags, termed "gutter flags," was to point out the position of the lead for the information of the parties holding claims ahead, and for the information of persons who might wish to take up block claims on either side of the gutter outside the boundaries of the frontage claim.

The object of the "frontage system" being to secure to the holders of each claim a given length of lead, neither more nor less, the difficulty that presented itself was to lay off the claims in such a manner as to cut up the leads into equal lengths: there would have been no difficulty in doing this had the leads held a straight course, but the serpentine windings of the leads rendered it a matter of impossibility to lay off claims on the surface in such a manner that each claim would contain only a given length of lead. Mr. Wall, in laying off the first frontage claims, adopted the plan of radiating lines running out from a fixed point, or datum peg, placed immediately over the gutter, at such an angle from each other as to include between them the gutter, with all its bends; and at equal or given distances along these radiating lines other lines (as boundary lines between the several claims along the lead), running from one radiating line to the next radiating line, in such a manner that the boundary lines between the several claims formed segments of an arc, of which the radial lines were the radii. At a later date, the mode of laying off frontage claims on the surface was altered thus. A right line was laid down in the direction of the supposed course of the lead, and upon such line the longitudinal boundaries of the claims were laid off at right angles to the aforesaid right line, and parallel to each other: these lines were

termed frontage parallels, and the holders of a frontage claim were entitled to sink anywhere between the parallel lines which bounded such claim. Upon the main trend of the lead being found to be different from that which had been supposed when the first lines were laid off, another right line was laid off from a new datum fixed at a point in the parallel line immediately over the gutter, and nearest to the point where the gutter was then being worked, and running in the direction of the then supposed course of the lead, and a new set of parallel lines were laid off along such right line, and thenceforward formed the longitudinal boundaries of the claims until some other change in the course of the lead should render necessary another set of parallels. After some time it was found that, owing to the frequent bends and changes in the course of the leads, the "right-angle parallels" were troublesome, on account of their having to be so frequently changed, and that they did not cut up the leads so equally as curved lines. It was also found that to adhere strictly to the idea of underground block claims led to the existence of spare ground between the several frontage claims on a lead, and that such spare ground was constantly made the subject of disputes and litigation. The local court, therefore, endeavored to find a mode of laying off frontage claims in such a manner that each claim should contain as nearly as possible a given length of the lead, and altered the regulations so that the holders of a frontage claim should be entitled to the whole of that portion of the lead lying between the longitudinal boundaries of such claim; the plan finally adopted was that known as plan "A," embodied subsequently by the Mining Board in the bye-law No. 8. The mode of laying off frontage claims, under plan "A," is in effect the same as that originally adopted by Mr. Wall, and by him applied to the Frenchman's and White Horse Leads.

In the early days of the "frontage system," the local courts framed a set of regulations for each lead, to which the so-called system was applied; but as the number of frontage leads rapidly increased, the Ballaarat local court adopted a set of regulations applicable to frontage leads generally.—(*Government Gazette*, No. 67, 12th June, 1856.)

Thenceforth it became the practice for the persons by whom a new lead was discovered, or the general body of the miners on the lead, to determine whether the lead should be worked as a frontage lead or otherwise. If it were to be a frontage lead, the warden was requested to proclaim it as such, under some name selected by the miners or the warden; and so soon as proclaimed the lead became subject to the frontage regulations. The next proceeding was to elect a surveyor for the lead, and to appoint or elect from the miners a committee to take charge of the general business of the lead, and to see that the surveyor performed his duties properly. The duties of the surveyor were to mark off the claims, receive applications for shares therein, and to register such applicants in the order of their respective applications. In some cases the whole of the miners present would tender their applications at the same time; and in such cases, if the order of priority could not be otherwise determined, the applicants had recourse to the ballot. The committee of the lead fixed the amount of the fee to be paid for registration by each applicant, and these fees were received by the surveyor, and handed over by him to the committee, who paid them into a fund, out of which they defrayed the expenses, the principal item of which was the allowance to the surveyor. In some cases one committee had charge of two or more neighboring leads. The most important of these committees was that known as the Central Committee, which had charge of the general business of the Gravel Pits, Golden Point, and Malakoff Leads; this committee consisted of one representative from each of the claims on the several leads, and each such representative was elected by the general

body of shareholders in the claim which he represented. The first important duty performed by this committee was obtaining the sanction of the owners of private property on the township to trace the leads through such property, on payment of compensation for surface damage, and to allow the privilege only to the registered holders of frontage claims, so as to secure to the claimholders the same advantages as they would enjoy under the frontage regulations upon waste lands of the Crown. This committee had also to assume, in respect of claims within private property, the functions of the local court and warden; and all disputes affecting such claims, whether as between copartners in the same claim, or between companies holding adjacent claims, not being cognizable by the local court or the wardens, were referred to this committee, and were by it determined, the parties in all cases yielding ready and implicit obedience to its decisions.

The committee was at one time called upon to protect the holders of frontage claims against persons who attempted to take up block claims within the frontage parallels, in violation of the frontage regulations; and, backed by the general body of frontage claimholders, it took such prompt and decisive measures, as not only effectually got rid of the encroachers, but set an example which deterred others from attempting to infringe the rights of the holders of frontage claims.

The size of a frontage claim, for twelve men, under the first regulations, was only forty feet in length of the lead, being three feet four inches of gutter per man for a full share; and as it sometimes, indeed frequently, happened that, in order to raise money to pay calls for working expenses and to support himself and family, the miner had to sell a half, or even three-quarters of his share, he would have only in the one case twenty inches, in the other case ten inches in length of gutter. The evil of such small claims soon forced itself upon the notice of the committee of the Frenchman's and White Horse Leads, and they caused the annexed statement to be prepared for the purpose of showing the necessity for larger claims.

Frenchman's Lead. Nos. of Claims.	UNPRODUCTIVE LABOR.			Expenses.	Gross produce.	Profits (taken as wages) per diem.
	Depth of shafts sunk.	Depth sunk through rock.	Length of drive to the gutter.			
	feet.	feet.	feet.	£	£	£ s. d.
No. 1 - - -	240	100	170	450	4,185	1 6 0
Nos. 2 and 3 -	305	170	120	718	6,260	0 17 6
Nos. 4 and 5 -	370	225	110	650	3,700	0 8 0
No. 6 - - -	335	120	130	700	4,050	1 6 0
Nos. 7 to 9 -	380	210	270	700	9,000	1 0 6
Nos. 10 to 12 -	440	250	90	2,000	6,500	0 10 0
Nos. 13 and 14 -	400	220	50	710	300	0 11 0
Nos. 15 to 19 -	800	430	110	1,000	9,100	0 9 0
Nos. 20 to 22 -	584	331	210	900	9,000	0 15 0
Nos. 23 to 27 -	912	641	370	3,050	15,000	0 9 0

The wages in this table are calculated upon the full share, hence it will appear that in Nos. 10 to 12 the holder of a quarter share would get only 2s. 6d. per diem.

In explanation of the depths of shafts and depths sunk through rock, I must state that in some cases, after a shaft had been sunk to a considerable depth, it was found

the lead was trending in another direction, and that shaft was then abandoned, and another shaft was sunk as near as possible to the supposed course of the gutter ; in some cases, shafts bottomed on the reef so far from the gutter that others had to be sunk. The depths given in the table are the aggregate depths sunk in one or more shafts by the several companies. The whole of the labor was performed by the shareholders, which accounts for the smallness of the expenses. The portions of shares sold by the working miner were generally purchased by storekeepers or persons engaged in some occupation other than mining, either for a lump sum of money, or for a weekly allowance, payable until gold was obtained or dividends were paid ; these interests were usually "sleeping" or "square" halves or quarters. Those interests in or portions of shares, in respect of which the holder was not required to contribute any labor nor to pay any wages (except his proportion of the wages paid for extra hired labor), was styled a "sleeping half" or "sleeping quarter" shares ; in some cases the holders of these shares had to pay the full share of the expenses for material and machinery. The holder of a "square" half, or quarter share, had to perform half or a quarter of the work, or pay half or a quarter of the wages for working it, and a half or a quarter of the expenses for materials and machinery. When the number of men in a company was increased by the union of several claims, so that the whole could not be profitably employed at one time, they were divided into "watches" or "shifts ;" the number of "watches" and the length of time each "watch" should work, was regulated by the number of working shareholders, and the number of men that could at one time be profitably employed on the mine. The time during which a "shift" or "watch" was at work was also termed a "shift" or "watch," and when there were only two "shifts," the twenty-four hours were divided into a "day shift" and a "night shift" of twelve hours each ; and in order to change the "shifts," so that those men who worked at night during one week might work during the day the next week, they had a "dog-watch" between the Saturday and Monday, the exact time of the "dog-watch" depending upon whether or not the work was continued throughout the Sunday. In some cases there were three or four distinct "shifts" or "watches," and then each "shift" would work only eight hours or six hours out of the twenty-four. When the number of "shifts" was so large, one man would sometimes work two or more shares, and for so doing would receive, in lieu of the ordinary wages, a weekly allowance of £1 or 30s. per share, and a half or a quarter of each share so worked.

In the earlier days, when it first became necessary to use timber as supports for shafts and drives, a certain number of the shareholders in a claim were sent into the bush to cut or split props, slabs, &c., which were brought in by teams owned or hired by the company. At a later date, slabs and props were supplied to the companies by persons who made a business of cutting them. Some time during the year 1857, sawn timber began to be used for slabs. At first a strong prejudice existed in the minds of the miners against it, as it was supposed sawn timber could not bear so great a pressure as timber split with the grain of the wood ; the prejudice, however, gradually wore away, and sawn slabs came into general use. When a claim had been worked out, the shaft and materials were usually sold, and the purchaser would take as many as possible of the slabs out of the shaft, this was termed "drawing slabs." For the purpose of drawing slabs, a stage was made to the shape of the shaft, small enough to be raised or lowered in the shaft inside the slabs ; this stage was lowered down the shaft by means of a rope at each end, which was made fast to some portion of the brace, and supported the stage. A man was then lowered by means of the windlass to

the stage, and as he drew out the slabs he sent them up by means of the windlass. As soon as he had drawn out a few sets the stage had to be raised level with or above the top of the space from which he had drawn the slabs, so that in case of the sides of the shaft where the slabs had been drawn falling in, the earth might fall down the shaft below the stage; sometimes, if the stage were not raised quickly enough, a quantity of earth from the sides would fall upon it, snap the ropes, and carry away the stage, the only chance the man had of saving himself was to cling to one of the ropes above the breaking point.

In some cases the materials were purchased by individuals, who let them to any company requiring them, receiving one or more sleeping or working shares in the claim for the use of them, the owner taking them away again when the claim was worked out. After a little time a number of storekeepers and miners, possessing means, purchased large quantities of materials for the purpose of furnishing claims, and thus the practice grew into a regular business of so much importance, that special provisions were inserted in the mining regulations respecting "furnishing shares." In later times it became the practice for the furnisher to supply materials of every description requisite (including materials for lighting, ventilating, blasting, &c., &c., but as a rule not including steam engines), until the shaft was bottomed or the gutter was reached, or until the gold was obtained. The expense of furnishing some of the claims on the deep leads at and about Ballaarat West and Sebastopol, where the shafts had to be sunk through rock and drift, was so great, that several of the furnishers were ruined before the gutter had been reached; and at length few could be found able or willing to engage in such a heavy undertaking. Moreover, it was found that the size of the claims was so small that, considering the average yields from these leads and comparing the yields with the cost of sinking through rock and drift, they would not pay; the business of furnishing claims was therefore abandoned. The owners of claims had then to find the means to purchase materials; and this led to the amalgamation of a larger number of claims, so as to reduce as much as possible the number of shafts to be sunk. The want of capital was much felt, and tended to retard the progress of mining enterprise, until the passing of the Act (commonly known as Pyke's Act) to limit the liability of mining partnerships led to the introduction of capital. The vast number of companies registered under that and subsequent Acts of a similar nature, is proof of the beneficial effect they have had upon the mining interest.

LEADS UNDER THE TABLE-LAND.

Gravel Pits Lead.—In October, 1855, at the time the Gravel Pits Lead was being worked on the eastern side of the Yarrowee Creek, a party of miners applied to Mr. Thomas Bath for permission to sink a shaft on his private property at the corner of Sturt and Lydiard streets; the permission was granted, and the shaft was at once commenced. This was the first shaft sunk on the table-land. The depth of the shaft was about 250 feet, of which 100 feet was rock, twenty feet of clay, and the remainder drift. The company, known as Bath's party, was eighteen months in sinking this shaft, with the help of an engine of ten horse-power, and a six-inch pump; after bottoming they had to procure a larger engine. They met with a great quantity of water in the drift, and also in the rock. They drove nearly to the N.W. corner of Sturt and Lydiard streets before reaching the gutter. The gutter was from 150 feet to 200 feet wide. The washdirt was a black gravel, containing large quantities of carbonized wood. This company drove nearly 300 feet west (*i.e.*, up Sturt-street), then turned under the old Council Chamber, broke into the drives of the Old Gravel

Pits Company at the back of the Council Chambers, and broke into the drives of the Clare Company under Bath-street. This company drove out about 650 feet of the lead, and obtained £17,000 worth of gold.

The Little Engine Company, consisting of fifteen shareholders, sunk a shaft on the north side of Sturt-street at the foot of the Camp Hill, behind the site now occupied by the Camp Hotel. Depth of shaft, 220 feet. The shaft was sunk through about forty-seven feet of rock, about twenty feet of drift containing an immense quantity of water, and bottomed in the gutter. The gutter was about twenty feet wide; and on the south side of the gutter the white reef paid seventy feet, and on the north side the green reef paid nearly the same width; the height of washdirt in the gutter was six feet, and on the reefs four feet. This company drove out about 1,080 feet of the gutter besides a great extent of reef-wash. They broke into the drives of Bath's party, just in front of the coach office which stands at the corner of Lydiard and Sturt streets; they broke into the drives of the Unicorn Company, in front of the Unicorn Hotel, in Sturt-street; they broke into the drives of the Constitution Company, in front of the Mechanics' Institute, in Sturt-street. They also drove out a considerable extent of ground under the Camp Reserve, partly in conjunction with the Big Engine Company. They commenced sinking in January, 1856; were twelve months engaged in sinking the shaft, and were engaged for two years in driving. The claim was abandoned as worked out in January, 1859. During the two years they obtained 7,800 ozs. of gold. The total amount of dividends paid was £24,960; and the expenses while sinking and driving, exclusive of the labor of the fifteen shareholders, and also exclusive of the cost of the engine and the materials for the shaft, were £6,240. They gave one sleeping share for furnishing the shaft, and four sleeping shares for the use of the engine. At one time, when the drives of the several companies were open to each other, they could walk from the Little Engine Company's shaft at the foot of the Camp Hill to the Waterloo Company's shaft at the foot of the hill under the Wesleyan Church Reserve.

The Big Engine Company sunk a shaft north of the Little Engine Company's shaft at the foot of the Camp Hill, and drove under the reserve and for some distance under Lydiard street, but got very little of the gutter. The Old Gravel Pits Company, consisting of seventy-two men, holding 1,800 feet of the Gravel Pits Lead, commenced operations on the 21st November, 1856, and sunk two shafts between Dana, Eureka, Lydiard, and Armstrong streets. No. 1 shaft was sunk through three feet of surface earth, eleven feet of brown clay, forty-five feet of first rock, ten feet of light-colored clay with sandy veins, two feet of drift, eight feet of brown clay, eighty-five feet of second rock, eight feet of brown clay, three feet of light-colored clay with sandy veins, thirty-five feet of drift containing a great quantity of water, five feet of light-colored clay, twelve feet of brown clay, fifteen feet of black clay, and fifteen feet of bed-rock; the depth to the centre of the gutter being 257 feet. No. 2 shaft was bottomed at 231 feet on a reef-wash. The time occupied in sinking the No. 1 shaft was five months, and in sinking the No. 2 shaft three and a-half months. The greatest quantity of water raised while sinking was 1,200 gallons per hour. The width of the gutter, including the reef-wash, was from 100 feet to 420 feet. The washdirt was black gravel, the bed-rock chiefly sandstone with veins of slate. The manager of this company, Mr. A. Dewar, being of opinion that, in order to work so large a claim profitably, some improvements should be made in the mode of raising and washing the dirt, about the 20th June, 1857, prepared a model of the shaft showing how trucks and cages, with water-tanks underneath, could be employed for raising the

washdirt and baling the water. His plan was adopted, and this was the first claim in which trucks, cages, and tanks were employed. The next consideration was an improved method of washing. Just about this time Hart's patent cylinder puddling machine was introduced, and probably suggested the idea which led to the adoption of a cylindrical puddling machine and sluice combined. This machine, which the company had made expressly for them, was erected at the foot of the hill on White Flat; on the north side of Dana-street, and the washdirt was conveyed to the machine in trucks, a tramway having been laid down on the north side of Dana-street, and the trucks being lowered down the hill by means of a pulley-wheel with a break attached, so that they could steady the trucks from running down too fast. The tramway, which was level with the street at the top of the hill, was raised above the level of the street towards the flat sufficiently high to allow of the trucks running over the top of the machine, so that the dirt could be shot into the hopper and so into the machine. This machine was so constructed that the stones and other refuse could be cleared away without disturbing the gold, which was cleaned out only once a week. The machine was worked for ninety-five weeks, and washed on an average 300 trucks of dirt per day. For some reason, this machine never came into general use. The average weekly yield was 110 ozs. 16 dwts. 3 grs.; the average weekly expenses were £350. The cost of shaft, including engine but exclusive of labor, was £2,250. The quantity of gold obtained from July, 1857, to February, 1859, was 8,864 ozs. 10 dwts. 10 grs. The total amount of dividends paid was £28,080. This company traced the Gravel Pits Lead from the back of the Council Chambers on the south side of Sturt-street, through the whole of the block between Armstrong and Lydiard streets into Dana-street, and thence across Lydiard-street into the Wesleyan Church Reserve, where they broke into the drives of the Waterloo Company, near the junction of the Gravel Pits and Golden Point Leads. A great number of companies were formed, and claims upon pieces of private property were taken up, but none of them got any portion of the lead worth mentioning. Of these, a company, known as the Unicorn Company, sunk a shaft behind the Unicorn Hotel in Sturt-street; and a company, known as the Constitution Company, sunk a shaft near the site now occupied by the Mechanics' Institute and worked a portion of the wash on the south side of the gutter. A company was formed, and sunk a shaft on the piece of land at the south-west corner of Lydiard and Mair streets, upon which the Post Office formerly stood, and which is now occupied by the Royal George Hotel, and they found a shallow lead, very narrow and not very rich, running down towards the Gravel Pits Lead from the direction of the railway terminus. They worked it for some distance, but did not trace it into the Gravel Pits Lead, as it was not sufficiently rich to pay for working.

The Golden Point Lead.—The claims upon this lead were originally laid off under the Local Court Regulations of the 12th June, 1856. A claim (under Class C.) for eight men was forty-eight feet in length of the lead, and a wall of six feet was left between the claims, so that the claimholders might be less liable to encroach upon their neighbor's claims.

On the 9th January, 1857, new regulations came into force, under which the sizes of claims were increased, and the holders of claims previously taken up were allowed to take advantage of the increase in the sizes of claims, provided they could do so without interfering with the rights of other persons. At that date (9th January, 1857) several of the companies had commenced sinking their shafts, and had expended much labor and money thereon, consequently they would not abandon them for the purpose of allowing the companies nearer to the source of the lead to get an extension

of their claims. Under these circumstances the Central Committee decided that three claims, comprising 384 feet in length, should be surveyed beyond the last claim on which work had been commenced, and that these three claims should be held jointly (in lieu of extensions) by the companies which were precluded from the advantages under the new regulations. The claims were held by a company styled the Extension Company, divided into thirty-eight shares, of which six were allotted to the Waterloo Company, six to the Clarendon Company, nine to the Union Company, nine to the Great Eastern Company, and eight to the North Grenville Company; and those companies had to send a man to represent each share so allotted. The other claims along the lead were resurveyed under the new regulations, and thus obtained claims of the increased size.

The Waterloo Company held four claims of forty-eight feet each, situated south of Dana-street, between Albert and Lydiard streets. The claim was worked by thirty-two men; commenced work on the 6th July, 1856; sunk the shaft to a depth of 200 feet in three months. Sinking—sixty feet rock, and the rest clay and gravel to the bed-rock; bottomed high on the reef; put in a drive at 200 feet deep, but found it was too shallow; sunk a blind shaft about twenty feet, and drove into the gutter at about the middle of their claim; found the gutter dipping very much. They put down an incline 130 feet long and thirteen feet deep, and laid tramway; but owing to the gradient (one in ten) they could not push up the trucks without the aid of a crabwinch, and they had to employ a wooden pump to raise the water up the incline. They struck the Gravel Pits Lead near the Wesleyan Church, the flow of water from which was so great that it rose 150 feet up the main shaft. When they got the water down again they attempted to puddle the water back in the drives, and failing there they puddled up the blind shaft; but the force of the water was so great that it forced up the ground about the blind shaft. Up to this time the claim had been worked with the help of a horse whim, but they had now to procure an engine. They then sunk the shaft to a depth of 235 feet, and put in a drive at that level to the gutter, and so worked it out in about one year and nine months. This company drove along the Golden Point Lead from a point near Albert-street, nearly into Lydiard-street, and under the Court House Reserve on the Golden Point Lead, and along the Gravel Pits Lead, which joined the Golden Point Lead under the Wesleyan Church, to a point under the Wesleyan School-house. The width of the Golden Point Gutter above the junction was about twenty-five feet, and below the junction about 100 feet. The total value of the gold obtained was £24,624 1s. 4d., and the aggregate amount of dividends paid was £19,776.

The Clarendon Company held four claims of forty-eight feet each, which were worked by thirty-two men. The shaft was sunk at the south-west corner of Dana and Lydiard streets, and bottomed shallow, but was sunk in the bed-rock to a depth of 240 feet, at which depth a drive was put in to the gutter. The width of the gutter and reef-wash was about 100 feet; the height of the washdirt was about five feet, with black clay for headings, and green slate reef and sandstone bottom. They employed a ten horse-power portable engine and a wooden puddling machine. The net value of the gold got was £9,600.

The Union Company held six claims of forty-eight feet each, which were worked by forty-eight men. The shaft was sunk at the rear of the Clarendon Hotel, to a depth of 247 feet. The first rock was struck just below the surface. Of this they sunk through thirteen feet; of the second rock, thirty-seven feet; and through forty-seven feet of drift, containing a great quantity of water. The

rest of the sinking was through clay. The sinking of the shaft occupied eleven months. The width of the gutter varied from thirty feet to eighty feet, and the height of washdirt from two feet to five feet. The dip of the gutter in this claim (viz., from Lydiard-street to Armstrong-street) was eighteen inches in 100 feet. They were seven months driving out. The highest dividend paid was £50 per man per week, and the net value of the gold obtained was £13,440. They had an engine and wooden puddling machine. The cost of sinking the shaft (exclusive of labor) was—for materials £288, and machinery £576.

The Great Eastern Company held six claims of forty-eight feet each, which were worked by forty-eight men. They commenced sinking on the 6th October, 1856. The shaft was sunk on a piece of land purchased by the company on the south side of Dana-street, between Armstrong and Doveton streets. They struck the first rock three feet below the surface, got through it at a depth of fifty-four feet, then sunk through a wet drift of about ten feet six inches; struck second rock at sixty-four feet six inches, got through it at 100 feet; at about twelve feet below the second rock struck second drift, got through it in two days; sunk through clay to a depth of 185 feet, where they struck a third drift, with a great quantity of water—they were eleven weeks sinking through this drift; struck the bed-rock at 223 feet; sunk in bed-rock, and opened out at 265 feet, on the 2nd May, 1857. The first gold was obtained about the beginning of June, 1857. The expense of sinking the shaft—including the purchase of machinery, but exclusive of labor—was £1,752. The net value of gold obtained was £13,440.

The North Grenville Company held five claims of forty-eight feet each, which were worked by forty men, and they gave two full sleeping shares for furnishing the claim until gold was struck. The shaft was sunk at the south-east corner of Dana and Doveton streets. The depth of the shaft was 270 feet, and was sunk through about 150 feet of rock, the remainder through drift and clay. The width of the gutter was about fifty feet, the height of washdirt was four feet six inches in the gutter and four feet on the reef. They were engaged nearly three years in sinking the shaft and working out the mine. The total value of the gold obtained was £28,000.

The Grand Junction Company held five claims of forty-eight feet each, and seventy-five feet of an extension. The claims were worked by forty men. The shaft was sunk near the National School-house, south of Dana-street, and between Doveton and Dawson streets. The shaft was sunk through sixty feet of rock, thirty feet of drift, fifty feet of clay, sixty feet of rock, forty feet mixed drift and clay, and fifty feet of bed-rock; the total depth being 292 feet. This company commenced operations in August, 1856, and finished in November, 1858. During that time they obtained 2,891 ozs. and 15 grs. of gold, and paid dividends amounting in the aggregate to £9,038. The width of the gutter in this claim was fifty feet.

The Extension Company held three claims, the aggregate length of which was 384 feet, which were worked by thirty-eight men. This was the claim given in lieu of extensions to the several companies. The shaft was sunk fifty-two feet east of Lyons-street and thirty-nine feet south of Eyre-street. The depth of the shaft was 295 feet. The width of the gutter was seventy feet. The height of the washdirt was four feet. The total value of the gold obtained was £7,688 5s.

The Homeward Bound Company held five claims of forty-eight feet each, and 216 feet of extension. The claims were worked by forty men. The shaft was sunk sixty-six feet east of Raglan-street and sixteen feet south of Eyre-street. This company gave two full sleeping shares for furnishing the shaft. The depth of the

shaft was 310 feet to the bottom of the well. Sunk through two layers of basaltic rock, about fifty feet of drift, and the remainder clay; reached the bed-rock at 298 feet. The width of the gutter was from 50 to 130 feet, the height of washdirt about three feet; the washdirt was a loose sandy drift with quartz and sandstone boulders. The shaft bottomed on gold about forty-five feet from the gutter. They were about two years sinking the shaft. They had a wooden puddling machine, an engine, and nine-inch pumps. The net value of the gold obtained was £11,760.

The New Constitution Company held five claims of 148 feet each, worked by forty men. Two shafts were sunk; first shaft at the corner of Eyre-street and Errard-street, bottomed at 172 feet. This shaft was sunk through ten feet surface earth, sixty-eight feet first rock, ten feet clay, twenty-six feet of drift, ten feet of clay, twenty feet of second rock, ten feet second drift, and eighteen feet of clay; but the shaft was abandoned without driving. The No. 2 shaft was then commenced at the corner of Urquhart and Errard streets, and was sunk through ten feet of surface, seventy-two feet first rock, twelve feet of clay, twenty-four feet of sand drift, ten feet of clay, twenty-four feet second rock, fourteen feet second drift, and ten feet of gravel and clay, and bottomed at 176 feet, and was then sunk 144 feet in the bed-rock, making a total depth of 320 feet, and drove 980 feet in reef before striking the gutter. The time occupied in sinking the shafts was about eighteen months. The cost of sinking the shafts and driving to the gutter, including cost of machinery but not including cost of labor, was £3,200. The average width of the gutter was about forty feet, the height of washdirt from three feet to six feet; the washdirt was loose black gravel, the bed-rock hard sandstone and slate. The total length of gutter drives was 1,400 feet. The total value of the gold obtained was £8,799 3s. 9d., and the total amount of the dividends paid £7,602. This company, on the 8th January, 1859, introduced flat sheets for turning trucks upon, they were the first to employ horses below to draw trucks along the drives. They also constructed a brick furnace below, for the purpose of ventilating the mine by means of air drives. They employed an engine and eight-inch pump, trucks and cages for removing and raising dirt, tramway along drives upon which to run the trucks. In this claim the Golden Point Lead was found to have varied from the supposed course, and to have turned almost at a right angle and run in a southerly direction towards the Nightingale Lead; and it was eventually discovered that these two leads formed a junction in the claim of the Telegraph Company. Some of the companies registered for claims on the Nightingale Lead sunk their shafts upon and were driving in the Golden Point Lead, under the supposition that it was the Nightingale Lead, and the mistake was not discovered till the New Constitution Company broke into the works of the Great Western Company. Then a lawsuit commenced between several companies on the Nightingale and Malakoff Leads respecting the identity of the leads being worked by the several companies parties to the suits, and the works in the claims were carried on under the direction of managers appointed by the Court of Mines. The result was, that the Golden Point Lead was found to have continued to run in a southerly direction after having been joined by the Nightingale Lead, and was then joined by the Malakoff Lead; and that the lead which had been worked as the Malakoff Lead was the lead formed by the junction of the Golden Point, Nightingale, and the Malakoff Leads.

The Cosmopolitan Company held five claims of 176 feet each, which were worked by forty men. They gave two sleeping shares for furnishing. This is the last case of furnishing of the deep leads, and the furnisher became insolvent before the company had reached the gutter. They commenced sinking the first shaft in February, 1857,

near the north-west corner of Eyre and Windermere streets. It was sunk through six feet of clay, and the remainder through basaltic rock to the bed-rock at a depth of 110 feet. The first shaft was then abandoned, and in August, 1857, the second shaft was commenced in Windermere-street, about midway between Eyre and Urquhart streets, and was sunk through four feet of surface earth, 112 feet of first rock, sixteen feet of clay, twenty-seven feet of second rock, six feet of clay, and 200 feet of bed-rock, to a depth of 365 feet. Were engaged about sixteen months in sinking first and second shafts; then put in main drive and air drive alongside, about 1,500 feet through reef, and about 500 feet of cross drives from main drive to air drive for ventilation, before reaching the gutter. Were employed fifteen months in constructing these drives. The greatest quantity of water raised by this company while sinking was 86,400 gallons per day. The average width of the gutter was 300 feet; the height of washdirt was four feet. The washdirt in the gutter was dark-colored gravel with black clay headings. The washdirt on the reef was a mixture of white, yellow, and red clay, gravel, and cement. The bed-rock or bottom was pipeclay, slate, and sandstone. The gutter was that formed by the junction of the Golden Point, Nightingale, Malakoff, and Milkmaid's Leads. This company employed horses below for the purpose of drawing the trucks along the drives. In June, 1859, they used (Round's patent) flat chains for winding. These are said to be the first employed. In June, 1866, this company introduced Denholm's patent safety cage. In June, 1858, this company purchased the shaft and claim of the Burra-Burra Company on the Milkmaid's Lead, and have since then worked their claim from that shaft. In the month of July, 1866, this company transferred a portion of the original claim, including the No. 2 shaft, to a new company styled the New Cosmopolitan Company, and since that date the works of the Cosmopolitan Company have been confined to the Burra-Burra shaft. The Cosmopolitan Company has recently suspended work, and it is supposed will abandon the claim as worked out. This company has been working more than ten and a-half years, and during that time no fatal accident has occurred in the mine. The value of the gold obtained is £181,040 1s. 9d. The cost of works, plant, &c. (exclusive of labor prior to the 14th September, 1864), is £60,283 19s. 9d., and the total amount of dividends paid is £129,784 5s.

The Koh-i-noor Company originally held five-claims of 176 feet each, worked by forty men, but they afterwards obtained an extension under the Mining Board By-law No. 10, covering the ground which had been held by the Atlas Company. The Koh-i-noor Company commenced operations early in the year 1857. The No. 1 shaft is situated near the south-west corner of Urquhart and Ascot streets, and was sunk through six feet of clay, eighty feet first rock, twenty-two feet of clay, sixty feet second rock, 150 feet of clay, and sixty-two feet of bed-rock, to a depth of 380 feet, at which depth the first main level was driven 1,100 feet before breaking through into washdirt. But it was too shallow; they sunk a blind shaft into the gutter, and then sunk the main shaft eighty-five feet deeper, and opened out at 460 feet, leaving a well fifteen feet deep. This main level was carried 1,000 feet, then an incline 125 feet long was put up thirty feet, and broke into the gutter near the blind shaft. From the end of the lower main level a branch main level was carried on to a distance of 1,650 feet from the shaft, and then an incline eighty feet long was put up and broke through to the gutter. The company commenced driving in September, 1858, and struck gold in August, 1859; paid the first dividend in September, 1859. This company employs 230 men, four steam engines, in the aggregate 130 horse-power, and eight puddling machines. The company has now been driving in washdirt a little over eight years,

and during that time has obtained gold to the value of £437,955 5s. 3d., and has paid dividends amounting in the aggregate to £250,060. This company has six horses employed underground in drawing the trucks along the drives; the space between the rails is properly metalled for the horses, and the stables are very compact. The whole of the stopes and drives are let by contract. This company has had a second shaft sunk by contract, near and to the westward of the Great Redan Extended Company's No. 1 shaft. In driving from the No. 2 shaft they found a small gutter coming in from the westward, but it was not deemed remunerative; and they are now engaged in cutting a main drive through reef to meet their workings from their No. 1 shaft, so as to be able to work the gutter from both shafts, and to secure thorough ventilation of the mine. The mine is at present ventilated by means of the air-duct.

The Koh-i-noor Company, about the beginning of the year 1863, commenced to sink their No. 2 shaft, near the old shaft of the Great Redan Extended Company. The depth of the shaft is 356 feet; it is sunk through six feet of surface soil, 120 feet of first rock, forty-two feet of clay and drift, 134 feet of second rock, twenty feet of clay, fourteen feet of third rock, and twenty feet of black clay and drift. The time actually occupied in sinking this shaft was nine months. The cost of sinking it was £4,628. The plant at this shaft consists of one engine thirty-five horse-power, one engine twenty-five horse-power, and four puddling machines, &c. The cost of the plant, together with cost of erection and all the fixings complete, was about £12,000.

The Atlas Company held five claims of 176 feet each, worked by forty men. They spent some time in shepherding, and afterwards commenced a shaft and sunk it to a depth of about 100 feet. They then entered into an agreement with the Koh-i-noor Company, under which they were to give up their claims to the Koh-i-noor Company, in consideration for which, the shareholders in the Atlas Company were to receive a certain number of sleeping quarter shares.

The Great Western Company held ten claims of 176 feet each, worked by eighty men. The greater part of these claims were laid off over private property; and as the lead was supposed at that time, early in the year 1857, to pass under the land over which the parallels had been laid off, the company purchased a small allotment of land and commenced boring to test the depth of the bed-rock. They afterwards made an arrangement with the owner of some other private property, and put down a bore on his land, but in consequence of some of the claims nearer the source of the lead not proving very rich, and some doubts being entertained as to the right to mine upon private property, they abandoned their claims about the middle of the year 1858. A portion of this company's claims, which extended into the Crown lands to the westward of the private property, was taken up by the Band of Hope Company; and at a later date, when it was found that the lead, instead of keeping a westerly course through the private property on which the Great Western Company had been boring, had turned off towards the Redan Lead (*i.e.*, to the southward); the Band of Hope Company made application for the remainder of the ground formerly held by the Great Western Company. This application was opposed, and a very important suit (commonly known as the "triangular law suit") was commenced, and led to the discovery of the junction of the Golden Point and Redan Leads, and to the fact that the lead which the Great Redan Extended Company had been working as the Redan Lead was the Golden Point Lead, and that the shaft and underground works of the Great Redan Extended Company were within that portion of the Golden Point Lead for which the Great Western Company had been registered. The suit was finally terminated by the fixing of boundaries between the parties to the suit; and the Great Redan Extended

Company paid to the Band of Hope Company the sum of £20,000 for a certain portion of the lead which had been awarded to the last-mentioned company.

The Band of Hope Company (consisting of 120 men) originally held fifteen claims of 176 feet each. They commenced boring for deep ground about the month of March, 1857, and continued about twelve months, when, having proved the existence of deep ground in that locality, they commenced, in the month of March, 1858, sinking the shaft afterwards known as the No. 1 shaft. During the year 1858 a great number of the shareholders abandoned their shares, and, owing to the prospects upon the lead at that time not being very bright, they experienced some difficulty in keeping together a sufficient number of the shareholders to work the claim. Since then, the Band of Hope Company has from time to time obtained extensions covering the ground formerly held by the Victoria Company, and a portion of the ground held by the Great Western Company; they have also, at various dates, taken up frontage claims upon the Inkerman, Golden Point, Redan, and Frenchman's Leads, and a number of block claims. In March, 1858, they commenced to sink the No. 1 shaft, but owing to this shaft being so great a distance from any other shaft, they had no assistance in draining the water from the rock, &c. They attempted to sink through the first rock without the aid of pumps, but the water was so very heavy that they had to stop the works and procure twelve-inch pumps; with these they were enabled after considerable time to get through the first rock and puddle it, but the force of water was so great that it burst the puddling two or three times, and it had to be re-puddled each time. After sinking some distance into the second rock the water again became too strong for the appliances, and they had to stop the sinking, cut down the shaft to its present size, and put in a fifteen-inch pump; even then the force of water was so great that they could scarcely make any progress in sinking; they however persevered, and after considerable time managed to get through the second rock and puddled it up, but the puddle again gave way under the pressure of water, and had to be repaired. About the month of October, 1862, they reached the bed-rock at a depth of 260 feet; they then sunk 80 feet in the bed-rock and opened out at 340 feet; after driving south-east a distance of 180 feet, they broke through into clay and then into drift, proving that the drive was too shallow for the deep ground; but they had no chance to repair the error then, for as soon as the drift was struck they were swamped out, and the quantity of sand that rushed in with the water was so great that it filled up the drive and nearly 100 feet of the shaft. This occurred on the 2nd February, 1863; so that nearly five years had been spent in sinking the shaft 340 feet, and driving 180 feet. They had then to pump out the water and remove the sand; this they found to be a most difficult task, on account of the sand destroying so many pump buckets that a considerable portion of the time was spent in repairing or replacing them; they also found, when they came to remove the sand, that as they took it out of the shaft a fresh lot rushed in. They opened out a drive higher up the shaft, and sunk down to the drift, and attempted to choke it up with clay; but this did not answer, as the clay gave way under the pressure of water; they then had recourse to filling in with stones, and these being too heavy to be moved by the water, the sand gradually filled in between them, and formed a solid wall, so that the sand could no longer run into the shaft. They then, after two years' labor, succeeded in getting out the water and sand. They then fitted a tank in the shaft to receive the water from the rock and drift, and pumped from this tank by means of the fifteen-inch pump, and they put down the twelve-inch pump to keep down the bottom water while sinking the shaft sixty feet deeper. The shaft was completed to the depth of 400 feet (its present depth) in April, 1866, that is

to say, in a little more than eight years from the time of commencing it. They then opened out and drove due east a distance of 170 feet, and put up a monkey-shaft a height of sixty feet, where they discovered what was supposed to be a new lead, and which was by the surveyor declared, on the 14th July, 1866, to be a frontage lead under the style of the Band of Hope Lead. The company were then registered for frontage claims upon that lead, but before they had time to explore even the width of this lead, they were again swamped out. They then determined upon purchasing the largest engine they could procure in the colonies, and finally arranged for the purchase of a beam engine 90 horse-power, and $22\frac{1}{2}$ -inch pumps; but before these were erected, viz., on the 21st September, 1866, they, under an agreement with the Hand-in-Hand Company, arranged to unite a portion of their claims (including the No. 1 shaft) with the Hand-in-Hand Company's claim, and to form a company under the style of the United Hand-in-Hand and Band of Hope Company, to work such united claims. After the "triangular lawsuit" it became clear that the Golden Point Lead could not be reached from the No. 1 shaft; the Band of Hope Company therefore purchased the shaft which had been sunk by the Golden Gate Company on the Redan Lead; the last-named company having worked out their claim and abandoned the shaft. The Band of Hope Company cut down the shaft to such a size as to suit their extensive operations, and erected suitable machinery, and then at once drove into the Golden Point or Main Lead beyond the point at which it had been joined by the Redan Lead. Since then they have driven about 1,400 feet along the course of the lead, the average width of which is 300 feet, and the height of washdirt from five to seven feet. The depth of the shaft is 420 feet, from which they have a main drive 2,900 feet in length, traversed by a double line of tramway, along which the trucks are drawn by horses to the mouth of the drive, whence they are sent up the shaft in cages. They have twelve horses employed in drawing the trucks, and the average number sent to the surface per twenty-four hours is 1,800. The main drive is lighted by means of gas (this is the only mine into which gas has yet been introduced), and the mine is ventilated by means of an air-engine; from the main drive monkey-shafts are put up, at suitable distances apart, into the gutter, the depth of which is about 380 feet; from these monkey-shafts drives are cut along and across the gutter, so that it can be worked with the greatest expedition. The quantity of washdirt raised to the surface in twenty-four hours is about 700 tons, and the largest yield of gold obtained in one day is 1,637 ozs., valued at £6,548. The quantity of ground excavated from this mine and washed up to the present time amounts to about 2,500,000 cubic feet, and the quantity of gold obtained from it is 161,943 ozs., the value of which is £656,869 5s. 2d.; and the aggregate amount of dividends paid is £388,000. The apparatus for washing the dirt from this mine consists of five iron puddling machines, two sludge machines, two buddles, and two sluices. The sluices are used for separating the gold from the dirt after it has been puddled in the puddling machines, and the sludge machines and buddles are used for saving or extracting the fine gold which is carried off in the sludge from the puddling machines. Towards the end of the year 1865 the company found that it would be necessary, in order to work their claims efficiently, to sink other shafts along the course of the lead; they therefore, as a preliminary step, set a number of men to work boring, so as to ascertain the position of the deep ground before commencing to sink; they put down six bores for that purpose, and then, on the 4th December, 1865, commenced their No. 3 shaft, situated on the south side of the Smythesdale-road, and completed it in the month of November, 1867. The depth of this shaft is 420 feet; the strata sunk through are as follow:—8 feet of clay, 82 feet of

first rock, 9 feet of clay, 104 feet of second rock, 22 feet of clay, 61 feet of third rock, 28 feet of clay, 84 feet of fourth rock, very hard. In one corner of the shaft they struck the bed-rock at a depth of 399 feet, and at the opposite corner of the shaft they struck it at 404 feet; the washdirt in the deepest part being between five and six feet. They then sunk about sixteen feet in the bed-rock, and opened out the chamber at about 414 feet. From the chamber they have cut two main drives, each seventy feet in length, through the bed-rock, and have opened up into the gutter, which is about ten feet above the level of the main drives. On the 26th September, 1866, they commenced sinking the No. 4 shaft, situate in the centre of the Radan Racecourse. This shaft is now about 324 feet deep, having been sunk through 103 feet of first rock, 9 feet of clay, 65 feet of second rock, 45 feet of clay, 74 feet of third rock, 2 feet of black clay, 26 feet of clay and drift, and they are now sinking in the fourth rock. The cost of sinking the No. 1 shaft up to the date of transfer to the United Hand-in-Hand and Band of Hope Company, on the 29th September, 1866, was £29,565 8s. 11d., distributed thus:—sinking, £17,476 10s. 6d.; sawn timber, £2,008 os. 1d.; laths, props, &c., £598 9s. 8d.; firewood, £5,791 11s. 1d.; ironmongery, £2,166 16s.; sundries, £1,524 1s. 7d. The cost of repairing and altering the No. 2 shaft and driving, to the 30th November, 1867, was £101,955 8s. 4d. The cost of sinking the No. 3 shaft was £11,859 12s. 9d., distributed thus:—sinking, £6,792 15s. 8d.; timber, £2,592 8s. 7d.; ironmongery, £812 6s. 4d.; firewood, £1,662 2s. 2d. The cost of sinking the No. 4 shaft to the 30th November, 1867, was £6,619 5s. 8d., distributed thus:—sinking, £4,202 9s. 6d.; sawn timber, £1,110 10s. 11d.; ironmongery, £777 17s. 9d.; firewood, £528 7s. 6d. The cost of the plant at No. 1 shaft to date of transfer, 29th September, 1866, was £4,781 8s. The plant at No. 2 shaft consists of four engines, aggregate 150 horse-power; and one air-engine, forty inches, besides the washing apparatus before mentioned; the cost of same, to the 30th November, 1867, was £17,295 15s. 4d. The plant at the No. 3 shaft consists of two engines, aggregate 120 horse-power; four puddling machines (iron); two sluices, and two buddles being erected—cost £8,003 8s. 5d. The plant at the No. 4 shaft consists of two engines, aggregate 80 horse-power, cost £3,108 6s. 7d. The cost of boring exceeds £3,000. The company has a very complete smelting apparatus at the No. 2 shaft, where all the gold is smelted.

The Victoria Company held fifteen claims of 176 feet each, worked by 120 men. They commenced boring in the year 1857, and continued until the year 1858, when they abandoned the claim without sinking a shaft. This was the last company formed on the lead. The ground was afterwards taken up by the Band of Hope Company.

White Flat Lead—Nightingale Lead.—In the month of February or March, 1856, what was then supposed to be a lead was discovered on the White Flat, near the Yarrowee Creek, and was proclaimed a frontage lead, under the style of the White Flat Lead, on the 7th March, 1856, but only a few claims were taken up on it, and these were subsequently abandoned. About the end of 1856 the lead was again discovered, and was again proclaimed a frontage lead, but this time under the style of the Nightingale Lead. Several claims were taken up, extending some distance into the table-land. The lead was traced across the White Flat, and into the table-land near the junction of Armstrong and South streets. The All Nations Company's claim was near the brow of the hill, and adjoined the claim of the Telegraph Company, in which the junction of this lead with the Golden Point Lead was discovered, and from this claim the Golden Point Lead was traced into the West Malakoff Company's claim, where it was joined by the Malakoff Lead. The Great Western Company held the next claims on the

Nightingale Lead, and they sunk a shaft and were driving for some time in a lead which they supposed to be the Nightingale Lead, but which afterwards proved to be the Golden Point Lead. After having worked the lead for some time, they broke through to the works of the New Constitution Company, and were at first under the impression that the latter company was working the Nightingale gutter. About this time the Sons of Freedom Company, who held the next claims to the Great Western Company on the Nightingale lead, broke into the works of the Great Eastern Company, which was registered for, and was supposed to be working, the Malakoff Lead; but the Sons of Freedom Company was of opinion that the lead being worked by the Great Eastern Company was the Nightingale Lead, and therefore commenced proceedings to establish their right to it. Suits were also commenced between the Great Western Company (Nightingale Lead), and the West Malakoff Company and British Company (Malakoff Lead). The Telegraph Company, on the Nightingale Lead, afterwards joined in the suit, which lasted some nine months, and resulted in the works being carried on under the direction of managers, captains, &c., appointed by the Court of Mines, which proved that the main, or Golden Point Lead, had passed through the claim of the Great Western Company into the Telegraph Company, where it was joined by the Nightingale Lead; that it then ran into the West Malakoff Company's claim, where it was joined by the Malakoff Lead, and thence through the British Company's Claim into the Great Eastern Company's claim. A dispute then arose between the Great Eastern Company (Malakoff Lead) and the Cosmopolitan Company (Golden Point Lead). The dispute was referred to arbitration, and resulted in the adoption of a boundary line between the said companies. About the same time it was found that the Milkmaid's Lead had also joined the Golden Point Lead, and therefore the Burra-Burra Company (the only company then working on the Milkmaid's Lead) were made parties to the arbitration, and a boundary was fixed as between that company and the Great Eastern and Cosmopolitan companies.

Malakoff Lead.—The Malakoff Lead was discovered about the beginning of August, 1856, by a prospecting party, in a claim near the Yarrowee Creek, at the lower end of the White Flat, and it was proclaimed a frontage lead. Eighty-eight claims were registered to the westward of the prospecting claim, and thirty-four to the eastward, but the greater number of these claims were never worked. To the eastward it was traced towards its source on the Golden Point Range, and to the westward it was traced into the table-land near the junction of Doveton and Sebastopol streets. From the prospecting claim to the West Malakoff Company's claim, which was about the junction of Dawson, South and Skipton streets, the lead was very narrow, and dipped very fast, so that little gold was found except in crab-holes, where the gold was generally large; but the quantity of gold obtained from these claims was not large. The West Malakoff Company, in whose claim the Malakoff Lead joined the main (Golden Point) lead, obtained a large quantity of gold, particulars of which I have not been able to obtain.

The British Company, consisting of forty-eight shareholders, were registered for claims on the Malakoff Lead. They sunk a shaft south of South-street, between Raglan and Skipton streets. They commenced sinking in September, 1856; they reached the bed-rock at 270 feet, and sunk in the bed-rock to a depth of 304 feet; the shaft was completed in January, 1858, and the drive through the reef into the gutter was completed in March, 1858. The width of the gutter was about 150 feet, and the reef-wash on the Milkmaid's Lead side of the gutter was about 160 feet wide. The cost of plant was £2,184; the value of gold obtained was £50,505; the dividends

amounted in the aggregate to £49,768. Rather more than half of the gold was obtained from the reef-wash.

The Great Eastern Company, of ninety-six shareholders, held twelve claims on the Malakoff Lead. They commenced sinking about the beginning of the year 1857, reached the bed-rock at about 290 feet, sunk in the bed-rock to the depth of 330 feet, and drove through bed-rock about 250 feet to the gutter. One portion of the gutter in this claim was only about twenty feet wide between very steep reefs; the gutter in that part was dipping fast, the washdirt presenting the appearance of clean-washed tailings, and very poor, yielding on an average not more than 2 ozs. per machine; but towards the junction of the Milkmaid's Lead, the gutter widened out to about 300 feet, and the dirt was much richer. About 110 feet from the shaft they found a reef-wash from ten feet to thirty feet above the level of the gutter, and from it they obtained more gold than from the gutter. Towards the junction of the Milkmaid's Lead there was a reef-wash, in some places nearly 300 feet wide. This company worked out about 2,000 feet of the gutter. They reached the gutter in October, 1858, and were engaged about three years in driving. This was the first company to employ a mining manager and captains of shifts. They had a twenty-five horse-power engine made to order in Sydney, as they could not get one large enough in this colony. This engine cost over £3,000. They had eight-inch pumps, and three wooden puddling machines lined with iron. This company was the first that used double lines of tramroad for trucks underground, and it was the second to use the cage. They had double drives, and a brick furnace for the purpose of ventilation.

Milkmaid's Lead.—The Milkmaid's Lead was discovered about the month of November, 1856, by a prospecting party, at the foot of the White Flat, near the Yarrowee Creek. From the point of discovery it was traced eastwards towards its source in the Golden Point, or White Horse Range, and westwards into the table-land at a point south-east of the junction of Skipton and Sebastopol streets. The gutter was narrow, and the washdirt comparatively poor, except at the lower end towards the junction with the main (Golden Point and other) leads. The Burra-Burra Company (the last company working on the lead), consisting of forty-eight shareholders, sunk a shaft near the junction of Skipton and Sebastopol streets to a depth of 300 feet. First, rock from the surface to a depth of sixty-four feet, then ten feet of brittle clay, then seventy feet of second rock harder than the first, then forty feet of tough yellow clay, which carried them to the bed-rock. They sunk in the bed-rock 116 feet, and drove eastward 240 feet before breaking through into the gutter. They were occupied ten months in sinking the shaft, and four months driving from the shaft to the gutter. The width of the gutter at the eastern end of the claim was twenty feet, the width increasing to the westward until, at the point of junction, it was sixty feet wide. Towards the junction was a flat reef, extending from the Milkmaid's to the Main Lead, and the wash upon this reef was very rich. The character of the washdirt was very different from that in the Main Lead, being stiff yellow clay and large boulders, not much water-worn, with but little drift. The bed-rock consists of alternate layers of sandstone and slate, the best of the wash being, as a rule, found upon the slate bottom. This company worked 2,250 feet of the gutter, and obtained 18,500 ounces of gold. The total amount of dividends paid was £49,300. The cost of sinking the shaft and driving to the gutter (exclusive of labor), including cost of engine, was £3,200. In sinking the shaft this company discovered a well-defined quartz reef, twelve feet thick. It was worked for twelve months, and proved a great failure. There is a shoot of gold dipping to the south, but it could not be worked without

sinking the shaft deeper, and therefore it was abandoned. This company is said to have been the first to introduce the air-duct.

Mount Pleasant Lead.—The Mount Pleasant Lead was discovered in the early part of the month of August, 1856, at Mount Pleasant; was traced towards that point in the Yarrowee Creek at which the Redan Creek falls into it, and it was joined near that point by the Miner's-right Lead.

Miner's-right Lead.—The Miner's-right Lead was discovered shortly after the Mount Pleasant Lead, near the north-west corner of Yuille's Paddock, on the lower road from Ballaarat to Buninyong, and was traced thence to its junction with the Mount Pleasant Lead. The sinking on these leads was chiefly through clay. There was a considerable height of washdirt, and the yields were generally very good.

Redan Lead.—The lead formed by the junction of the Mount Pleasant and Miner's-right Leads was proclaimed as a new lead, under the style of the Redan Lead. This lead entered the table-land near the Redan Gully. The sinking was chiefly through rock containing a large quantity of water, and with the appliances, windlasses and whims, then employed, great difficulty was experienced, and a very long time was spent in sinking. The claims were so small that they scarcely repaid the labor and capital expended upon them, with the exception of the Golden Gate Company's claim and the Great Redan Extended Company's claim.

The Golden Gate Company's claim was 648 feet in length. They commenced sinking in the month of September, 1856, and did not bottom the shaft until January, 1859. The shaft was sunk through first rock from the surface to a depth of fifty-nine feet, then about six feet of clay; then through 109 feet of second rock (the last six feet of which was so hard, and contained such a quantity of water, that they were twelve months in sinking through it); then through sixty feet of clay. At the depth of 234 feet they found symptoms of a third rock. Then through clay to the depth of 280 feet, where they found about three feet of fourth rock of a soft and porous nature. The total depth of the shaft was 302 feet. This company consisted of fifty-two men. They drove 1,100 feet of the gutter, and raised about 33,000 ozs. of gold. They employed one engine, nineteen horse-power, and two wooden puddling machines. Since this company has abandoned the claim the Band of Hope Company has purchased it, and is now working the main lead from the shaft.

The Great Redan Extended Company, consisting originally of eighty men, commenced sinking in the month of February, 1857. They sunk a shaft to a depth of 350 feet, and bottomed within fifteen feet of the gutter. The shaft was sunk through four layers of rock of considerable thickness, and about thirty feet of drift. Both the rocks and the drift contained a very large quantity of water. This shaft was so far from any other at that time sinking that they had no means of knowing beforehand what difficulties they were likely to encounter, and consequently had, from time to time, to make alterations in their appliances. While sinking through the second rock they had to employ two pumps, each eight and a-half inches in diameter, to keep down the water, the influx of which was so great that if anything happened to either of the lifts they had at once to draw up the men from the shaft. They were occupied three years in sinking the shaft. The width of the gutter varied from about sixty feet to 400 feet, the average width being about 250 feet, and the average height of washdirt was five feet. The washdirt was dark clay, gravel, and sand, with quartz boulders. The bed-rock was chiefly hard sandstone. The expenditure prior to getting gold was £6,280, exclusive of labor. On the 3rd August, 1864, the company was registered under the Limited Liability Act. This company is said to have been the first to

employ the buddle in washing. Their works were very extensive and well arranged. They usually raised 1,000 trucks of dirt every twenty-four hours. They had gas laid on from the mains to their engine-house and puddling machines. The total quantity of gold raised from this claim was 109,572 ozs. 5 dwts., the value of which was £438,289 7s. 11d.; and the aggregate dividends paid amounted to £347,890. Some time since they abandoned their old shaft, having, on the 15th July, 1866, commenced sinking a new shaft, which is now 330 feet deep. They have been twelve months employed sinking through ninety-five feet of first rock, twelve feet of clay, ninety feet of second rock, and three feet of clay. They reached the bottom at 200 feet, and have sunk in it 130 feet. For the new shaft the cost of machinery, &c., is £2,500, the cost of materials is £1,480, and the cost of labor is about £4,320.

Woolshed Lead.—The Woolshed Lead was discovered in May, 1858, between the White Horse Range and the Yarrowee Creek, and was traced towards its source on the western slope of the White Horse Range, nearly opposite to the point on the eastern side of the range from which the Sailor's Gully Lead was traced. From the prospectors' claim, in which the Woolshed Lead was first discovered, it was traced in a westerly direction towards the table-land. The lead towards the shallow end was rich, as much as 20 ozs. of gold being in some cases washed from a tub of dirt; but towards the table-land it was "patchy," owing, probably, to the fact that the lead was dipping fast. About the end of 1858 a prospecting party commenced to sink a shaft on the table-land, near the brow of the hill, and having found the gutter, traced it a considerable distance with varied success; but on the whole it was found that, in consequence of the lead dipping so fast to the westward, the deposits of gold would not pay for working. The gold was large, and some patches of very rich washdirt were found, from which the prospectors inferred that the lead where it had ceased to dip so fast would be found to be very rich. This induced them to continue working the lead to the westward, until their means being exhausted they were compelled to desist. After some little delay a new company, styled the St. George Company Limited, was formed, and continued the exploration of the gutter to the westward a distance of 600 feet, the main drive having to be cut through very hard reef. This company, like the former one, expended all its capital, and the claim was sold in September, 1863, to the St. George United Company, who commenced a shaft 1,500 feet further west, and bottomed at 380 feet, after having sunk through four distinct layers of basalt rock. They have continued to work the lead since that date, some portions of which have proved very rich. It is supposed by the management that the reefs or sides of the gutter will be found to contain deposits of rich washdirt, and a monkey shaft was put up from the main drive some time since for the purpose of prospecting the reefs. This shaft broke through into a kind of drift washdirt considerably above the level of the gutter. They followed the wash a considerable distance towards the deep ground, until they found the fourth layer of rock below and the third layer of rock above this wash or drift, which had been proved to contain gold in sufficiently large quantities to pay for working. The wash appears to continue between these two layers of rock; but owing to the great quantity of water issuing from the rock they were unable to follow it with profit. Moreover, they have other and richer ground in their claim, which they were anxious to work, therefore they left this ground to drain for the present, intending when less busy in other parts of the mine to return to and work it. Though gold has frequently been found in drifts lying between beds of clay at various heights above the level of gutters, only one other instance has come to my knowledge of gold being found in a drift lying above or between basaltic rock. The depth of the

main level is 380 feet; but they have other levels at less depths up to fifty feet and shallower. It is believed that a "payable" quartz reef exists between the No. 1 and No. 2 shafts; but it is not proposed to test this until the alluvial ground shall have been worked out. The plant consists of two engines, aggregate sixty-five horse-power, five iron puddling machines, and two buddles. The value of the gold obtained is £122,886 19s. 3d. The amount of capital paid is £16,500; and the amount of dividends paid is £32,922 10s.

Deadhorse Lead.—About the latter end of the year 1852, or the beginning of the year 1853, the shallow ground at the head of Deadhorse, Frenchman's, and Jenkins' Gullies, situate on the western slope of the Dividing Range, was opened. The runs from these several gullies were traced to a point near the Ballaarat Vineyard, where they joined and formed the lead since known as the Deadhorse Lead. The ground was worked intermittently until the month of July, 1857, when a great rush took place, and the lead was then proclaimed a frontage lead. Some ten claims were marked off eastward of the prospecting claim, and about 140 claims to the westward. A great number of shafts were commenced, extending more than a mile along the course or supposed course of the lead; but in consequence of the large quantity of water and the rotten nature of the ground (it being composed chiefly of fine gravel and sand), a large number of the shafts were lost before reaching the bottom; other shafts were, owing to the difficulties met with, abandoned, and some bottomed on the reef; and though in most cases these drove a short distance, little or none of the lead was worked at that time. In the early part of the year 1858 a great number of the claims were abandoned, but since then the lead has been worked and some portions of it have paid very well.

The Ballaarat Extension Company commenced operations in January, 1862. They sunk a shaft on the east side of the Creswick-road to a depth of 235 feet, through twenty-five feet of surface clay, fifty feet of rock, sixteen feet of drift, seventy-two feet of clay, and seventy-two feet of bed-rock. Sixteen men were engaged ten months in sinking the shaft, which was bottomed in November, 1862. They drove 230 feet through bed-rock, and put up a blind shaft and broke into the gutter at a depth of 205 feet. In order to do away with the necessity for the blind shaft, they opened out at 218 feet and drove into the gutter at 205 feet deep; they worked about 2,500 feet in length of the gutter, the depth of which, at the last point worked, was 212 feet. The average width of the gutter was about sixty feet, the height of wash-dirt from three to six feet. The washdirt was dark-colored quartz-gravel; the bed-rock was alternately slate and sandstone. The total amount of calls paid was £12,250. The first gold was washed in November, 1863. The total value of gold obtained was £43,547 3s. 7d., and the total amount paid in dividends was £11,500. The plant consisted of two engines (twenty-five horse-power and fourteen horse-power), two iron puddling machines, and a nine-inch plunger lift. The mine was ventilated by means of an air-duct, and the supply of air from it was so good that they never had a day's stoppage from bad air. The company suspended works in July, 1867, and it is doubtful whether they will resume.

The Rose Hill Company commenced, in the month of April, 1865, to sink a shaft, half a-mile east of the Rose Hill Hotel, on the Creswick-road. The shaft was sunk to a depth of 260 feet, through twenty-four feet of surface clay, fifty-four feet of rock, twenty feet of drift, 103 feet of clay, and fifty-nine feet of bed-rock. Sixteen men were engaged twelve months in sinking the shaft. The shaft bottomed within twenty feet of the gutter. The gutter was reached at a depth of 220 feet, and they have

drives through about 1,300 feet of it. The depth of the gutter, where they are now working it, is 240 feet. The average width of the gutter is 100 feet, and the height of the washdirt is from three to six feet. The washdirt is black gravel, very stony. The bed-rock is alternately reef and sandstone. The total amount of calls paid is £9,975. The total value of gold obtained is £14,800 1s. 6d. No dividends have yet been paid. The plant consists of two engines, each twenty-five horse-power, three cast-iron puddling machines, and a ten-inch plunger lift. The mine is ventilated by an air-duct, which gives a plentiful supply of fresh air throughout the mine. The first gold was washed on the 28th November, 1866.

The Great Northern Junction Company commenced boring in March, 1865; and having discovered the position of the deep ground, commenced, in May, 1866, to sink a shaft about a quarter of a mile west of the Rose Hill Hotel. The shaft was sunk through six feet of surface clay, ninety feet of rock, and 168 feet of drift and clay; making together 264 feet, at which depth they reached the bed-rock; the shaft was then sunk a further depth of eighty-six feet in the bed-rock, making the total depth of the shaft 350 feet. The shaft was completed in the month of August, 1867. Since then an upper chamber has been cut at a depth of 300 feet, and a lower chamber at a depth of 340 feet. The plant consists of an engine, thirty horse-power; an engine, twenty-five horse-power; and a twelve-inch plunger pump, which has recently been substituted for a fifteen-inch drawing lift. While sinking, this company had some portion of the time to pump as much as 30,000 gallons of water per hour; at present they are pumping only about 10,000 gallons per hour.

The Great North-West Company's claim was taken up about the month of August, 1862; boring was commenced on the 9th September of the same year, and on the 8th September, 1863, the sinking of the shaft was begun. On the 23rd May, 1864, the plant, consisting of a thirty-two-inch cylinder pumping engine, and a twenty-five horse-power winding engine, was started. The first rock was got through at a depth of thirty-three feet; the shaft was sunk through eleven feet of clay, 144 feet of the second rock, twenty-eight feet of clay, fifty-seven feet of third rock, eleven feet of clay, and is now down twenty-seven feet in the fourth rock. It has been ascertained by boring that the thickness of the fourth rock is forty-eight feet, and that under the fourth rock is a bed of clay, twenty-three feet in thickness, which reaches to the bed-rock, making the total depth of the bed-rock from the surface 355 feet, so that only forty-four feet remain to be sunk to reach the bottom. It is thought by the manager that the gutter will be struck at a depth of about 400 feet; but it is not at present known on which reef (that is to say, on which side of the gutter) the shaft is being sunk, consequently prospecting drives will have to be cut to prove the position of the gutter before putting in the main drive, unless the dip at the bottom of the shaft shall indicate the position of the gutter. Several leads, shallower than the Deadhorse Lead, are believed to be trending in the direction of the Great North-West Company's shaft, or through the country immediately surrounding it. The extraordinary quantity of water met with by this company in sinking has occasioned numerous and serious delays. These delays have to some extent been caused by the machinery (which, when erected, was the most powerful in the colony) proving insufficient to overcome the vast quantity of water. Added to this, a serious accident occurred some months since, which almost totally destroyed the thirty-two-inch cylinder pumping engine. Since then great improvements have been made, more steam-power obtained, and much larger pumps put in the shaft. The pumping apparatus at present in use is actually throwing water at the rate of 2,000 gallons per minute, or 2,880,000 gallons per day

of twenty-four hours. Notwithstanding that the shafts of the Great North-West Company and the Hand-in-Hand and Band of Hope Company are three miles apart, during the time that the pumps in the Great North-West Company's shaft were idle, it was noticed that the water in the shaft was being lowered apparently by reason of the water being pumped out of the Hand-in-Hand and Band of Hope Company's shaft, and when pumping was resumed at the Great North-West Company's shaft after the Hand-in-Hand and Band of Hope Company had been pumping some time, the quantity of water flowing into the Great North-West Company's shaft was less by 200 gallons per minute, than it had been prior to the stoppage of the Great North-West Company's pumps; consequently the water was pumped out in less time and with greater ease than was anticipated by the manager, who had made careful calculations of the quantity of water flowing into the shaft prior to the stoppage, at which time the pumps of the Hand-in-Hand and Band of Hope Company were idle. From more recent observations and calculations it appears that the quantity of water flowing into the Great North-West Company's shaft has not been affected by the pumping in the Hand-in-Hand and Band of Hope Company's shaft, but the quantity of water flowing into the Hand-in-Hand and Band of Hope Company's shaft increases during any lengthened stoppage of the Great North-West Company's pumps. During a stoppage in September last, to put in a new clack, the water rose 100 feet up the shaft; but in one hour and forty minutes after the pumps were got to work again the whole of the water was pumped out, and the men were at work on the bottom. The company has three engines covered by a substantial brick engine-house, two for pumping and one for winding. One of these, a Cornish single-acting pumping engine, is a condensing engine, or what is commonly but erroneously called a low-pressure engine, as the pressure of steam used at the present time in working this engine is nearly 60 lbs. to the square inch. The cylinder of this engine is forty inches in diameter, and the stroke is nine feet in the piston and eight feet at the pumps. It is now being worked up to twelve strokes per minute. The Cornish engines are the best adapted for doing very heavy pumping work, as the direct action obtained by them is the most advantageous where there is a very great strain, the inevitable consequence of pumping with a large column of lifts. In these engines the number of strokes is not regulated by the pressure of steam, but by an ingeniously contrived apparatus, styled the cataract. This is done by water, pumped into a small cistern, being caused to flow through a valve, the opening of which is increased or decreased at pleasure, and the rapidity or slowness of the escape of the water acts on a valve by which the steam is admitted, and the interval between the strokes regulated. The single-acting pumping engine works in the following manner:—One end of the beam is attached to the piston rod, the other end being attached to the pump rods over the pit, the pumping rods and plunger pole being of sufficient weight to force the water up the column of pipes of the plunger pump. When the steam valve at the top of the cylinder is opened by the action of the cataract, the steam presses on the top of the piston to force it down, but instead of the steam being admitted into the cylinder during the whole length of the stroke, it is cut off before the piston reaches the bottom of the cylinder, and the momentum given to the heavy pump rods and the expansion of the steam in the cylinder drives the piston to the lower end of the cylinder and completes the stroke; then a valve at the top of the cylinder, called the equilibrium valve, opens, and as the piston is raised by the weight of the pump rods, it allows the steam to pass down a pipe leading from the top of the cylinder to the bottom, where it occupies the space within the cylinder below the piston when the piston has reached the top of the cylinder; and immediately before the

steam valve is again opened, a valve, placed between the bottom of the cylinder and the condenser, is opened, and the steam rushes into the condenser where it is met by a jet of water which condenses it, thereby creating a vacuum in the cylinder below the piston, which does away with the back pressure of the atmosphere, and thus economises steam. The water is pumped out of the condenser by means of an air pump. The saving in steam by working it expansively depends upon the point in the stroke of the piston at which the steam is cut off. For example, by cutting off the steam when the piston has travelled only one-tenth of the length of the stroke, a saving of two-thirds is effected as compared with engines where the steam is not cut off till the piston has travelled the full length of the stroke; but to effect this saving by working the steam expansively, a larger engine has to be employed than would otherwise be required. The difference in the quantity of fuel consumed by a condensing as compared with a non-condensing engine is very great. It has also been proved in this district, that by fitting an expansion valve to an engine, 100 tons of firewood did as much work after the valve was fitted as 150 tons had done before. The cylinder is enclosed in a neat wooden casing, and everything in the engine-house is plain and substantial. The beam is constructed of wrought-iron instead of cast-iron (which is generally used), in order to save freight in the transit from England, as a cast-iron beam of the same strength would be fully three times the weight, and there is less danger of the wrought-iron beam breaking and falling down the shaft, as happened at the Hartley Coal Mine, in the case of a cast-iron beam. The other pumping engine is also a beam engine; it has a 32-inch cylinder, is double action, has a four-foot stroke, and works to 100 horsepower, with thirty-five strokes per minute. To this engine an expansion valve has lately been fitted for the purpose of saving fuel. This also is a condensing engine, and the saving of steam effected by a vacuum being formed is equal to that in the Cornish engines. The pumping shaft is $10\frac{1}{2}$ inches in diameter, and the spur and driving wheels are fourteen inches across the faces, and have been pitched and trimmed, so that the strain will come equally across the faces of the cogs. The fly-wheel is twenty feet in diameter. The beam connecting the power of the engine to the pumps is a massive iron casting, and measures thirty-two feet in length, the weight of it being over twenty tons. By means of the cog-wheels the piston makes three and a-half strokes to one of the pump; the stroke of the pump, which is at present seven feet long, can be reduced to three feet. The winding engine is twenty-five horse-power. The feed pump of this engine has been made to work a hydraulic ram placed over the pit for the purpose of lowering and raising the pumps, and has been found to work well. This hydraulic machine does the work of thirty men and several horses; and the columns, great as is their weight, can be raised or lowered with the greatest nicety. Mr. Isaac Wheeldon, the inventor, applied for a patent for this machine, but he has not taken it out, as it would be required in only very few instances in this colony, it being chiefly suitable for very heavy columns of lifts. Three boilers supply the steam required for the engines. Two of these were made on the ordinary principle, but have since been strengthened by having angle-iron rings fitted round the flues, and have been tested up to 90 lbs. to the inch. Mr. Isaac Wheeldon was the first person in the colony who so employed the angle-iron rings. After the bursting of the Durham Company's boiler, the new flues put in were strengthened by angle-iron rings; these rings have also been applied to the flue in the new boiler at the Band of Hope Company's No. 1 shaft. It is now almost an invariable practice in this district to strengthen the flues of boilers by means of angle-iron rings, and in no instance has a flue so strengthened collapsed. In one instance a new boiler was tested with cold

water to a certain pressure, and the flues collapsed ; the plates of the flue were taken out and put into proper shape, and then put back again ; angle-iron rings were fitted round the flue, and then the same pressure being applied the flue stood the test. Boiler No. 3 is of a different and an improved construction, known as Galway's patent, having seven cross-water tubes. These tubes pass diagonally across the flue behind the furnace, and by affording a much greater heating surface enable steam to be got up quicker than in an ordinary boiler, they also act as very powerful stays to the flue, doing away with the necessity for angle-iron rings in that part of the flue ; but the angle-iron rings are employed to support the part of the flue which is used as the furnace. This also is an improvement introduced by Mr. Wheeldon, and is the first of the kind made in the colony. This boiler has been tested up to 110 lbs. pressure to the square inch. All the boilers are thirty-one feet three inches long, by six feet six inches in diameter, with forty four-inch flues. The two first-mentioned boilers are generally worked up to a pressure of 35 lbs. to the inch, and the latter from 55 lbs. to 60 lbs. The boilers are connected by pipes having valves so placed that the steam may be cut off from passing from one to the other. No. 3 boiler holds more water than either of the others, but steam can be got up in it from cold water half an hour quicker and with less fuel than in either of the others, thus proving the benefit derived from the cross-water tubes. It was urged as an objection against the use of these tubes that the heat became exhausted before leaving the boiler, and thus prevented the draught being good. In order to test the validity of this objection an experiment was tried, by placing a piece of gas pipe, plugged up at the lower end, and half filled with water, in the flue between the boiler and damper. By means of a steam-gauge affixed to the top of the pipe it was found that in three minutes fourteen seconds the pressure of the steam generated in the pipe reached 150 lbs. per inch, and as the gauge could not indicate a higher pressure than this, no means were afforded of ascertaining what greater amount of heat passed up the chimney. This simple experiment proved that if the heating surface had been augmented by increasing the number of cross-water tubes, there would still have been ample heat passing into the flues to cause a good draught. The company are so well satisfied of the saving of fuel effected by the use of the cross-water tubes, and of the additional strength of flue gained by the use of such tubes together with the angle-iron rings, that they have recently ordered a boiler thirty-six feet long with twelve cross-water tubes and two angle-iron rings. This boiler is to be tested up to 130 lbs. to the inch. The pumps consist of two columns. To a depth of 210 feet both pumps are plungers, and for the remaining depth draw-lifts. One drawing lift is 21½ inches and the other 18½ inches diameter. The former is attached to the 32-inch and the latter to the 40-inch cylinder engine. The shaft or pit is 9 feet by 6 feet 6 inches, at the plunger workings it is 12 feet by 9 feet, and at the tanks 21 feet by 12 feet. In the clay in places, timber 12 inches thick is used for slabbing, and in the rock, where it is solid, the timber is from 3 to 4 inches thick. To enable the men to ascend the shaft without the aid of the engine, in the event of anything going wrong with it, a ladder is placed in the pump-shaft, and near the bottom, where the men are blasting, a chain ladder with iron rings is used. Another simple contrivance has been introduced for protecting the men from the risk of falling when being lowered down or raised up the shaft ; the contrivance consists of rings of iron large enough for the hand to be put through, attached by means of two or three links of a small chain to the chain on which the bucket hangs. The men can catch hold of these rings and thus get a secure hold. A shoe, at the top of the ring, prevents the hand being jammed against the chain. Several lives have been lost

through the bucket catching against the centres or sides of the shaft, and the men being unable to hold on to a thick wet chain or rope have been precipitated to the bottom of the shaft; whereas a man can get such a much better grasp of one of these rings, that he could scarcely be thrown off the bucket under any circumstances. Companies having to pump a very large quantity of water, especially where sand, &c., are mixed with the water, or when the working barrel is much worn, have found that the necessity for frequently renewing the gearing of the pump bucket seriously retards the progress of the works, and entails a great waste of money, as the working expenses during the time spent in changing the buckets for the purpose of renewing the gearing and pumping out the water accumulated during the delay are as great as while the works are in progress. The expense and delay suffered by the Great North-West Company from this cause were so great that the manager, Mr. Wheeldon, directed his attention to the introduction of an improved bucket and gearing. The bucket known as Wheeldon's free-gear'd pump bucket, can be made of cast or wrought iron or other metal, &c. The bucket is round, with a groove on the outer circle for holding the bucket gearing or ring, which gearing is free to press the working barrel of the pump. Apertures are made through the flange forming the top part of the groove to the top or back of the bucket gearing or ring, so as to allow the water or fluid to press the gearing against the inside of the working barrel of the pump, and against the bottom flange forming the groove round the outer circle of the bucket, to form a sufficiently water-tight joint. The gearing or ring of bucket is made of gutta-percha (but may be made of leather, cast-iron, or other suitable material), in one piece (if made of iron or other metal it would need to be made in two or more segments), and of such a size as nearly to fill the groove round the bucket. The joints in the ring are tongue-lap and cover joints, so that they may remain water-tight as the front of the gearing wears away and the ring or gearing is made to expand. The ordinary gearing used to last in the Great North-West Company's pumps about five days. The time occupied in changing buckets for the purpose of renewing the gearing, and getting the water down again, was as a rule ten hours, and the working expenses of the company average 30s. per hour, so that the cost of changing the bucket may be set down at £15. Since the company commenced, on the 26th November last, to use the patent buckets, fully seven times as much water has been pumped as was ever pumped by them with an ordinary bucket, and the same gearing is still in use; in other words the gearing of the patent bucket has out-last'd seven gearings of the ordinary buckets, and the company has thereby already saved some £105 at the very least. The pumping engines and gear are built with great strength, and large masses of bluestone masonry, cemented and bolted together, keep the machinery in as steady order as the great and constant strain and jerking of the pumps will permit. The cost of the works and plant is £38,000.

Essex Lead.—About the month of June, 1858, a company, styled the Essex Prospecting Company, commenced to sink a shaft about half a-mile due north of the Wendouree Swamp. The first shaft sunk was bottomed at eighty feet, and was found to be too shallow, therefore another shaft was sunk, which bottomed in the gutter at a depth of 130 feet; the shaft was sunk a further depth of seventy feet in the bed-rock, making the total depth 200 feet; a drive was opened at that depth, and was driven 1,500 feet before the gutter was struck. The portion of the gutter between that point and the shaft was worked by means of blind shafts from the main drive. From the point where the gutter was struck it was followed about 1,500 feet, in which space it had dipped thirty feet, making the depth of the lead at the then lowest

point 230 feet. The gutter was first discovered in the month of April, 1860. The width of the gutter was from thirty to fifty feet, and well defined. The height of the washdirt was three feet; the nature of the bed-rock a soft slate. The company continued to work as a co-operative company until the month of July, 1861, when it was registered under the Mining Partnerships Limited Liability Act. While a co-operative company it consisted of thirty-two shareholders. It worked out 3,000 feet of the gutter and obtained 741 ozs. 12 dwts. 19 grs. of gold. The calls made amounted to £4,000. The plant then consisted of a ten horse-power engine, eight-inch lifts for pumping, and one wooden puddling machine. After it became a "limited" company the plant consisted of a twenty-five horse-power engine and two iron puddling machines. The value of gold obtained as the Essex Company Limited was £27,892 15s. 5d., and the amount of calls paid was £51,200. The company was dissolved a few months since. Only one other company of any consequence worked on the lead; and that styled the Oriental Company was formed to mine upon private property. The Essex Company's works adjoined the works of this company, and a dispute arose, but was finally arranged, an agreement being entered into, under which the Essex Company was to work out the ground and pay to the Oriental Company fifty per cent. of the gold.

Swamp Lead.—The Swamp Lead was discovered near the Cemetery Quartz Reef, during the year 1857, and was traced by some co-operative companies from the Quartz Reef towards the Durham Company's claim on the north side of the swamp.

The Durham Company commenced sinking in 1858. They sunk a shaft eastward of their present shaft, through the rock, but were unable to sink through the drift which was under the rock; consequently that shaft was abandoned, and the present shaft was commenced and was sunk to a depth of 270 feet—the strata sunk through being 152 feet of rock, eight feet of drift and clay, and 110 feet of bed-rock. A drive was cut at that depth, in an easterly direction 720 feet, and the gutter was struck on the 21st July, 1863. The gutter was found to be trending south-west, and a drive was then cut from the shaft in a southerly direction, which met the gutter 600 feet from the shaft. The gutter was followed a distance of 420 feet; but it dipped so much that the water could not be got out without great expense, and the fall of the gutter was too steep for trucking. Since then the shaft has been sunk 155 feet deeper, and a main level has been put in 1,150 feet, which has occupied two years and a-half. The bed-rock is very hard, and little timber is used in driving. The width of the gutter varies from ten to forty-five feet; the height of washdirt varies from two to three feet. The washdirt is chiefly clay, with no washed or water-worn stones in it. The plant consists of one engine (thirty horse-power), two puddling machines, and a sluice. The value of gold obtained is £2,760. The calls paid amount to £30,000.

Inkerman Lead.—The Inkerman Lead was first opened about the beginning of November, 1854, in the Inkerman Gully, on the western slope of the Black Hill Range. The lead was traced from the shallow end to a depth of about fifty feet or sixty feet. About July, 1855, in consequence of the quantity of water met with in sinking, and the comparative poverty of the washdirt, the lead was abandoned. About the month of March, 1857, a prospecting claim was taken up near the Gnarr Creek, and about the month of July, in that year, the lead was discovered near the point at which it was joined by the A 1 Lead. The Inkerman Lead was proclaimed a frontage lead in July, 1857; but a difficulty arose as to the appointment of a surveyor, in consequence of one portion of the miners on the lead being in favor of the appointment of Mr. Robert Davidson, while another portion were in favor of Mr. Blaney W.

Walshe. The result was that both these gentlemen were appointed, two committees for the lead were elected, and two lines of parallels were laid off. Under ordinary circumstances this would have led to serious disputes, but as in the case of this lead nearly the whole of the land along its course had been alienated, there were, in effect, no frontage claims, except one or two between the prospecting claim and the Creswick-road and the Great Republic and Hand-in-Hand Companies' claims, south of Mair-street, towards the Golden Point Lead. The persons who had been registered for the intermediate claims made such arrangements as they best could with the owners of private property for permission to mine under such property, and mined the lead under such arrangements. The depth of the Inkerman Lead at the point where it was discovered, in July, 1857, was about 100 feet; the washdirt was dark-colored gravel, and very poor, yielding only about $2\frac{1}{2}$ ozs. to the puddling machine-full; but below the junction of the A 1 Lead it was much richer. Early in the month of October, 1858, and on several occasions subsequently, this lead was swamped out, and great damage was done to the underground works of the several companies. The water was supposed to come from the rock in the shaft of the Montezuma Company, which was situated nearer to the swamp than the other shafts. The loss and inconvenience suffered by some of the companies by reason of their mines being so frequently swamped led to the combination of the Ophir, Independent, and Great Republic Companies, for the purpose of purchasing the shaft sunk on the north side of Mair-street and west of Drummond-street, by the Catch-me-who-can Company, and the erection thereon of an engine and pumps to drain the rock water. The engine was kept continually pumping, and thereby the rock water was prevented from accumulating and bursting in upon their mines.

The Allied Armies Company occupied Mr. Greene's property, known as Greene's paddock, on the east side of Drummond-street, between the Creswick-road and Webster-street. In November, 1857, the company commenced sinking the first shaft in the north-east corner of the paddock near the Creswick-road. This shaft reached the bed-rock at a depth of 150 feet, and was only seventy feet from the gutter, the depth of the gutter being at that point 180 feet. The width of the gutter was nearly 200 feet, and the depth of washdirt about three feet. In one portion of the claim there was a bend in the gutter, and it there formed a sort of basin, from which they took washdirt to a height of twelve feet. After the ground in this part of the lead had settled down, they took out the ground which had fallen in to a height of twelve feet; again, when the ground had again fallen in and settled down, they took it out again to the height of six feet, and from the dirt last taken out, which was a kind of clay and drift mixed, they obtained a nugget weighing 9 ozs., besides the fine gold. The dirt from which this was obtained must have been originally nearly thirty feet above the bottom. The extent of the basin was about three acres, and the earth above it having since then fallen in has left a hollow in the surface. This company sunk a second shaft, near the corner of Webster and Drummond streets. The second shaft was sunk to a depth of 210 feet, ninety-five feet of which was basaltic rock, and 115 feet bed-rock. They had to drive 1,200 feet through bed-rock before reaching the gutter. The dirt was brought along the drives in trucks, sent up the shaft in buckets, and then wheeled in trucks to the puddling machines. The plant consisted of one engine fourteen horse-power, one engine sixteen horse-power, and three wooden puddling machines, and it cost £2,500. The company was engaged three years in driving, and the value of the gold obtained was £101,350. During the time this company was driving for the Inkerman Lead they discovered a quartz reef, but did not work it to any extent. In the month of

October, 1862, a company was formed, under the style of the Emerald Company, for the purpose of working this reef; they worked upon it for some time, and spent a considerable sum of money in the purchase and erection of machinery. At the outset they obtained some very rich quartz, but the yields fell off, and on the whole the reefs were not remunerative, consequently the claim was abandoned, and the company was wound up on the 10th December, 1863. The paddock on the opposite side of Drummond-street was leased to two companies, known respectively as the Montezuma and Unicorn Companies; but the portion of the Inkerman Lead under this paddock was so poor, and the companies were so frequently flooded out by the rock water bursting into the Montezuma Company's shaft, that they abandoned their claims without having obtained any considerable quantity of gold.

The Ophir Company occupied the property at the south-west corner of Drummond and Webster streets. They commenced sinking in the month of October or November, 1857. They reached the gutter at a depth of 200 feet. The width of the gutter was between seventy and eighty feet.

The Independent Company occupied some property on the west side of Drummond street, south of that occupied by the Ophir Company. This company commenced sinking about the same time as the Ophir Company. They struck the gutter sixty-six feet west of their shaft, at a depth of 208 feet. They broke into the works of the Ophir Company on the north side, and they drove south-west and broke into the works of the Great Republic Company under Mair-street, between Windermere and Ascot streets. The width of the gutter in this company's claim varied from 80 feet to 100 feet. The value of gold divided by this company, after paying expenses, was £34,100. This company was flooded out on five several occasions by reason of the water from the rock bursting in upon them.

The Catch-me-who-can Company occupied some property on the north side of Mair-street and west of Drummond-street; but they were so late in starting to sink, that before they had reached the bottom the portion of the lead for which they were sinking had been worked out, consequently they abandoned the claim, and their shaft was purchased by the adjacent companies to be used as a pumping shaft for the purpose of draining the rock water.

The Great Republic Company commenced sinking on the 10th of September, 1857, and sunk the first shaft immediately west of the Hospital Reserve. This shaft was sunk almost entirely through rock, and was bottomed at about 100 feet. The first shaft was abandoned as being too shallow, and a second shaft was sunk in Ascot-street north of Sturt-street, to a depth of about 240 feet (the New Don Company is at present working from this shaft). The company sunk a third shaft, west of Ripon-street and north of Sturt-street, to a depth of 278 feet; the strata were as follow:—seven feet of surface earth, 130 feet basaltic rock, eighteen feet stiff clay, twenty-nine feet basaltic rock, eighty-three feet of mixed clay, gravel, and drift; five feet of washdirt, and six feet of bed-rock. The width of the gutter was from 100 feet to 250 feet; the height of washdirt was from four to seven feet. The washdirt was a dark-colored coarse gravel mixed with clay, containing large quartz boulders, charcoal, and decayed wood. The country was heavily charged with water, and on several occasions the works were flooded, in some cases endangering the lives of the men; and, in most cases, the water brought with it thousands of tons of loose gravel and sand, which completely blocked up the drives. The rush of water usually continued several days, but was soon baled out by means of pumps and tanks. The clearing of the sand and gravel from the drives usually occupied four or

five weeks. The plant consisted of three engines of twenty-five horse-power each, and three puddling machines.

In the month of August, 1862, while engaged in blocking out the Inkerman Gutter, this company discovered a new lead about 100 feet north of the junction of Ripon-street north and Sturt-street, at a depth of 220 feet. This lead was declared a frontage lead under the style of the Republican Lead, and the discoverers were registered for a frontage claim upon it, about 2,000 feet in length, which extended across a block claim previously taken up by the Sir William Don Company. The course of the Republican Lead was about south-east, and the Republic Company traced and worked it under and some distance to the south of Sturt-street, and consequently into the block claim of the Sir William Don Company. The last-named company then commenced proceedings against the Great Republic Company for encroachment. This was the commencement of the great case, *Critchley v. Graham*, which lasted about two years and a-half, and the law costs in which amounted to about £5,000. The width of the Republican Lead was fifty-five feet, the height of washdirt eight feet; the washdirt was a tough red clay intermixed with large boulders and gravel. The gutter rose very fast, the depth at the point where it crossed the northern boundary of the Sir William Don Company's block claim, viz., under Sturt-street, being only 203 feet. In consequence of the legal proceedings instituted by the Sir William Don Company, the Republic Company was prevented from tracing the lead any further. In June, 1864, about three months after the termination of the suit *Critchley v. Graham*, the company was wound up, in consequence chiefly of a disagreement between the holders of sleeping and working shares. The quantity of gold obtained was 29,506 ozs. 2 dwts. 7 grs., sold for £117,455 12s. 10d. The amount of capital subscribed was £2,824. The cost of works and plant was £32,161 12s. 10d., exclusive of the labor of eighty shareholders during nearly seven years. The aggregate amount of dividends paid was £88,118. The prices obtained for the gold varied from 78s. 3d. to 82s. per ounce. In September, 1862, the aggregate value of the shares in this mine was £96,000. This was the first claim on the lead south of the Creswick-road that was upon Crown land.

The Hand-in-Hand Company held the last frontage claims registered on the Inkerman Lead; in fact, at the time claims on this lead were being laid off, it was supposed the Inkerman Lead would join the Golden Point Lead before it reached the point to which this company's claims would extend, consequently only a portion of the claims were then surveyed; but subsequently, when it was found the Golden Point Lead was trending further south, the remainder of the claims applied for by this company were surveyed. In the month of August, 1857, the company commenced sinking a shaft near the corner of Dana and Ripon streets; they were engaged six months in sinking to the bed-rock a depth of 125 feet, in consequence of the works being stopped on several occasions by the warden at the instigation of persons interested in the Golden Point Lead, who thought that lead would trend through the Hand-in-Hand Company's claim. They afterwards sunk the shaft 160 feet in the bed-rock, opened a drive at 285 feet, and drove a distance of 1,600 feet, where they put up an incline about twenty feet and struck the Inkerman gutter at a depth of 265 feet below the surface. The company, consisting of eighty shareholders, worked as a co-operative company until the month of July, 1863, when it was registered as a limited company under *The Mining Partnerships Limited Liability Act*. In the month of August, 1859, they began to obtain gold, and continued until the month of December, 1863; during that time they obtained £54,420 1s. 3d. worth of gold, and

paid in dividends the sum of £36,520. The gutter was well defined, but varied in width from 50 feet to 250 feet; and the height of washdirt varied from five to eight feet. The washdirt generally was a loose white gravelly wash, but in places it was of a very dark color, resembling the washdirt in the Gravel Pits or Golden Point Gutters. The reef was soft, of a white color, and easily worked. They drove in the direction of the late Victoria Company's shaft, a distance of 3,000 feet; about 2,000 feet of this drive was through washdirt. They also constructed air-drives, 1,600 feet in length, distant from the main drive forty feet. The plant consisted of a steam engine of twenty-five horse-power, two puddling machines, the sides and bottoms of which were covered with sheet-iron one-eighth of an inch thick, and sluices to wash off the dirt after it had been puddled. Underground they had seventy trucks drawn by horses along wooden rails covered with quarter-inch iron. While prospecting on the reef they discovered a wash which led to the taking up of the claim afterwards known as the Sir William Don Company's claim, in the month of August, 1861, by the working shareholders in the Hand-in-Hand Company. In the month of June, 1861, the Hand-in-Hand Company commenced sinking their No. 2 shaft, and by the month of December of that year they reached the depth of 115 feet, when they stopped sinking, and did not commence again until the month of November, 1864; they then continued sinking until they reached the bottom, in the month of December, 1865. The depth of this shaft is 410 feet; the strata sunk through as follows: 135 feet first rock, 10 feet clay, 80 feet second rock, 15 feet false bottom, 10 feet drift, 6 feet washdirt, and 154 feet bed-rock. A drive was opened at a depth of 315 feet, and has been driven several hundred feet, and the washdirt has been tapped in various places for the purpose of draining it, as it has been found necessary in order to work that ground efficiently that the water should be first drained from it. They are now working the wash at a depth of from 275 feet to 305 feet, by means of rises put up at various points along the main level to the washdirt, the results obtained being very satisfactory. The plant at this shaft consists of a fifty horse-power horizontal engine for pumping and puddling, a forty horse-power horizontal engine for winding, and six iron puddling machines sixteen feet in diameter. Each machine will hold 150 trucks of washdirt, the truck containing three cubic feet of dirt. The value of gold obtained from this shaft is £9,510 16s. 10d. The claim known as the Sir William Don Company's claim having been taken up originally by the working shareholders in the Hand-in-Hand Company, led to disputes between the sleeping and the working shareholders in the last-mentioned company, and resulted in the formation of a distinct company under the style of the Sir William Don Company, and the transfer to the said company of the Sir William Don Claim and the No. 1 shaft of the Hand-in-Hand Company. On the 21st of September, 1866, the claim of the Hand-in-Hand Company was united with that portion of the claim of the Band of Hope Company in the vicinity of the Public Park; and the United Hand-in-Hand and Band of Hope Company was formed to work it. The shaft which had hitherto been the Band of Hope No. 1 shaft, now became the United Hand-in-Hand and Band of Hope Company's No. 1 shaft. The Hand-in-Hand Company's No. 2 shaft became the United Hand-in-Hand and Band of Hope Company's No. 2 shaft. One of the first things done by the new company at the No. 1 shaft was to erect a ninety horse-power beam-engine, and twenty-two and a-half inch lifts for pumping; the erection of this was completed in the month of December, 1866. A drive was then constructed bearing ten degrees east of south, and at a distance of about 250 feet from the shaft they discovered washdirt; three or four machines of this dirt were washed and proved highly remunerative; but in

consequence of an immense influx of water they were prevented from prosecuting the works further. The value of gold obtained from this shaft was £1,200. In the month of October, 1866, the United Hand-in-Hand and Band of Hope Company commenced a shaft within the Public Park, which they sunk to a depth of 260 feet; the strata sunk through were—first rock 125 feet, clay thirty-five feet, second rock fifty feet, and bed-rock fifty feet; they completed the shaft by the month of July, 1867. They opened a main level at a depth of 250 feet, and drove south a distance of 200 feet through bed-rock to the wash, which they struck by means of a monkey-shaft, at a depth of 235 feet. The height of the washdirt is about six feet; but the width of the wash was not proved by this company. The value of gold obtained from this wash was £4,517 18s. 1d.

About the middle of the month of November, 1867, the United Hand-in-Hand and Band of Hope Company transferred this shaft and that portion of their claim within the Public Park to a new company, styled the Park Company. In the month of November, 1866, they commenced a shaft between the corporation sale yards and Winter's private property. This shaft was sunk to a depth of forty feet by wages men; since then it has been sunk by contract, and is now in the second rock at a depth of 170 feet.

UNITED HAND-IN-HAND AND BAND OF HOPE COMPANY—STATEMENT OF COST OF PLANT, ETC., ETC.

Cost of No. 1 shaft since transfer from Band of Hope Company :—

	£	s.	d.
Plant - - - - -	9,193	15	3
Wages - - - - -	10,128	2	2
Firewood - - - - -	3,442	9	0
Driving timber - - - - -	1,119	12	2
Driving (contract) - - - - -	474	16	10
Sawn timber - - - - -	1,426	17	9
Charcoal - - - - -	135	11	6
Ironmongery - - - - -	2,319	17	10
	<u>£28,241</u>	<u>2</u>	<u>6</u>

No. 2 shaft :—

	£	s.	d.
Plant - - - - -	3,556	17	0
Wages - - - - -	11,925	2	6
Firewood - - - - -	2,559	7	3
Driving timber - - - - -	2,586	9	4
Driving (contract) - - - - -	4,555	4	10
Sawn timber - - - - -	901	4	8
Charcoal - - - - -	60	13	0
Ironmongery - - - - -	1,751	3	7
	<u>£27,896</u>	<u>2</u>	<u>2</u>

No. 3 shaft:—

	£	s.	d.
Plant - - - - -	49	11	0
Wages - - - - -	182	5	2
Shaft (contract) - - - - -	907	6	10
Sawn timber - - - - -	265	19	5
	£1,405	2	5

The Royal Saxon Company obtained from Mr. Thomas Bath a lease for mining purposes of his land at the corner of Sturt and Pleasant streets. On the 14th October, 1858, the company commenced sinking the No. 1 shaft, at the south-east corner of the paddock. The shaft was sunk to a depth of 345 feet; the strata sunk through were—154 feet of first rock, 15 feet of red clay, 37 feet of second rock, 65 feet of drift gravel and clay, and 74 feet of bed-rock. The time occupied in sinking the shaft was eleven months, and the number of men employed was eighteen. The width of the Inkerman Gutter in this property was on an average 150 feet; the height of the washdirt varied from four to six feet; the wash was a loose quartz gravel, and the bed-rock was sandstone and slate. On the 23rd of November, 1863, the company commenced the No. 2 shaft, which was sunk to a depth of 261 feet; the strata sunk through were—145 feet 6 inches of first rock, 20 feet of white clay, 35 feet 6 inches of second rock, 27 feet of mixed clay, 33 feet of bed-rock. This shaft was sunk for the purpose of working a tributary of the Inkerman Lead, known as the National Lead. The time occupied in sinking the shaft was ten and a-half months, and the number of men employed in sinking it was twenty. The average width of the National Lead was fifty feet; and the height of the washdirt varied from one to six feet. The washdirt was a tough clay intermixed with quartz; the bed-rock was slate and pipeclay. The National Lead was discovered by the Royal Saxon Company, on the 1st of May, 1861, and was traced into the Inkerman Lead, under Pleasant-street north, about 300 feet N. 30° E. from the shaft. This company ceased washing in the month of September, 1867; since then the plant has passed into the hands of the Sir William Don Company. The quantity of gold obtained by the Royal Saxon Company was 26,633 ozs. 1 dwt. 6 grs., value £105,532 6s. The total amount of calls paid up was £49,837 14s. 6d., and the total amount of dividends paid was £45,000. The surface works were lighted by gas.

The Leviathan Company was formed about the same time as the Royal Saxon Company, for the purpose of mining upon the land on the opposite side of Sturt-street, the property of Mr. Thomas Vaughan. This company bottomed a shaft and drove some distance through the bed-rock into the Inkerman Gutter, when a suit was commenced by the Hand-in-Hand Company, which resulted in the breaking up of the Leviathan Company.

In the month of October, 1859, a party of miners, afterwards known as the Southern Cross Company, obtained permission to occupy, as a mining claim, a piece of land lying between Sturt-street and the Swamp, and then known as the Survey Reserve. This company sunk a shaft on the reserve near to Sturt-street, to a depth of 350 feet. The strata sunk through were—8 feet of surface clay, 129 feet of first rock, 9 feet of mixed clay, 39 feet of second rock, 8 feet of clay, 157 feet of bed-rock. The length of time occupied in sinking the shaft was eighteen months, and the number of men employed was twenty-two. A main drive was cut at a depth of 350

feet, and at a distance of 325 feet north-east from the shaft they bored up and discovered the Inkerman Gutter at a depth of 327 feet. After the discovery of the National Lead by the Royal Saxon Company, the Southern Cross Company put in a main drive through the bed-rock a distance of 2,300 feet in a north-easterly direction, and discovered the National Lead at a depth of 190 feet, but it was found to be very poor, as was also the portion of the Inkerman Lead worked by this company. After this company had worked for some length of time without success, a new company, styled the Victoria Company, was formed in June, 1864; this company continued to work the claim until the beginning of September, 1866, when, having exhausted its capital, it was wound up. The value of gold obtained by the Southern Cross Company was £2,765 5s. 2d.; and the value of gold obtained by the Victoria Company was £2,354 14s. 10d. The amount of calls paid by the Southern Cross Company was £21,629; and the amount of calls paid by the Victoria Company was £13,371. No dividends were paid by either of the companies. In the month of September, 1866, the claim was transferred to the Hand-in-Hand Company, but was not worked by them.

The Tannery Company was formed in 1858, to work a claim adjoining the Copenhagen grounds. They sunk a shaft to a depth of 410 feet, with the intention of working the Inkerman Gutter. The strata sunk through were—10 feet of loam and clay, 165 feet of rock, 2 feet of black clay, 10 feet of red clay, 5 feet of yellow clay, and 218 feet of bed-rock. After driving a considerable distance in various directions, and putting up numerous bores, without discovering the Inkerman or any other lead, the claim was abandoned by this company. The claim was afterwards worked by another company, styled the Copenhagen Company, but without any better success than the former. About the beginning of 1866, the Inkerman and Durham Junction Company took possession of the claim, and having repaired the shaft and drives, and put in a drive at a depth of 400 feet about 450 feet due west, they put up several bores along the course of this drive, but could not discover any wash; they then abandoned the lower workings, and opened out a drive at a depth of 240 feet, and drove about 1,400 feet east by south. From this drive they cut branch drives, one due south, which broke through into the Western Freehold Company's works under Eyre-street. From the main drive, at about 500 feet from the shaft, they put up a monkey-shaft seventy feet into washdirt. They put up a second monkey-shaft, which broke into washdirt forty feet above the level of the main drive; a third monkey-shaft reached the wash at thirty feet above the main drive, and a fourth monkey-shaft broke through at twenty-five feet. The wash is wide-spread on an undulating reef. The average height of washdirt is three feet, and the width about 200 feet. The value of gold obtained by this company is £14,960 2s. 5d.; the amount of calls paid is £23,625; and the amount expended in labor only is £20,492. No dividends have been paid. Several other companies, such as the Star Freehold Company and the St. Leger Company, were formed to mine pieces of private property, but after sinking shafts and driving some distance without success, they abandoned their claims.

A 1 Lead.—The A 1 Lead was opened in July, 1857, and was proclaimed a frontage lead, and claims upon it were surveyed and registered as far as the Turf Hotel, on the Creswick-road. The prospecting party who discovered this lead obtained about £3,200 worth of gold, after paying expenses.

The Homeward Bound Company's claim, between the prospecting claim and the junction of A 1 and the Inkerman Leads, was the richest on the lead. From it £14,800 worth of gold was obtained, after paying expenses. In the claim next to the

Homeward Bound Company's claim a tributary was discovered; it was a narrow, well-defined lead, quite dry; it was named Bridget's Lead, and was traced from the A 1 Lead to the quartz reef known as the Cemetery Quartz Reef, on the west side of the Cemetery. The party holding this claim obtained £4,000 worth of gold, clear of expenses. The claim known as the Junction Claim was commenced in October, 1857. The depth of the shaft was 107 feet, fifty-two feet of which was through loose rock. The shaft was sunk in three weeks and three days. The width of the gutter was from sixteen feet to twenty feet; the height of the washdirt from two feet and a-half to three feet, and the average yield was 16 ozs. per puddling machine. The claim was worked by means of a horse-whim. The dirt was wheeled along the drives in barrows, slabs or laths being laid down to wheel upon. The time occupied in sinking the shaft and working out the claim was ten months. There were eight men in the party, and the amount of money divided amongst them, after paying expenses, was £7,200. The lead from the prospecting claim towards the Turf Hotel became gradually poorer, and only about nine claims from the prospecting claim in that direction paid for working. The gold from this lead was considered of very fine quality, and, as a rule, one shilling per ounce above the ordinary rate was paid for it by the gold-buyers. The sinking was chiefly through yellow clay and clay drift, with a quantity of water. There were no great difficulties in sinking, but the ground required care in driving, as it did not stand without being well supported. The whole of the lead was worked out and abandoned by the first parties in about twelve months after the date of discovery.

Haphazard Lead.—This lead was discovered in a claim situated on the west side of Drummond street, which had been taken up for the purpose of working the Inkerman Lead, to which the Haphazard Lead was a tributary. The sinking on this lead was chiefly through red and white clay. The washdirt was a red clay-gravel; some portions of it were rich. The lead was narrow, and was dipping very fast. The lead was traced from the Inkerman Lead to its source, viz., the Cemetery Quartz Reef. The whole length of the lead was only about 1,600 feet.

The Sir William Don Company was formed in the month of June, 1865, when the shaft formerly known as the Hand-in-Hand Company's No. 1 shaft, and the claim taken up by the working shareholders in the Hand-in-Hand Company, were transferred to them. They opened a drive at 230 feet deep, and drove a distance of 1,000 feet, and put an incline twenty-eight feet into the Republican Gutter, which they struck at a depth of 202 feet. The gutter was about fifty feet in width, and the height of washdirt was about six feet. They worked about 570 feet in length of this gutter. They afterwards drove in a northerly direction from their shaft, a distance of 230 feet, and put up several bores, when they discovered the wash which has since been declared a frontage lead, under the title of the Sir William Don Lead. The depth of this lead is 196 feet from the surface, running in a south-westerly direction; the width is 230 feet, and the height of washdirt is seven feet. The washdirt is a coarse gravel. At the southern end of the claim a great quantity of cement has been found, containing gold. In a south-easterly direction from the shaft a new lead was discovered in September, 1867, about sixty feet in width, and trending about south-east. Alongside of this lead is a quartz reef containing gold; a drive has been cut fifteen feet into this reef without getting through. It is worthy of remark that the washdirt found by this company is not upon a flat reef, but in a series of leads or runs, of greater or less width; that they appear to start from nearly the same point, and trend in different (in some cases opposite) directions towards the deeper leads; and that from the quartz reef known as the Cemetery Quartz Reef, situate nearly due

north of the Sir William Don Company's claim, several shallow leads, viz., the Swamp, Haphazard, and Bridget's Leads, have been traced down into deep leads. The discovery made by this company has led to the opening up of a very great extent of auriferous ground; on the one hand from the Cricket Reserve towards the public park; more recently along the line of the Inkerman Gutter, commencing in Mr. Greene's paddock, near the corner of Webster and Drummond streets, and extending in every direction; and at the present time companies are being formed to work the reefs alongside of gutters which have long since been worked out. About the month of September, 1867, this company purchased the plant of the Royal Saxon Company, and used one of the shafts for the purpose of keeping down the water from the Inkerman Lead, lest it should, if allowed to rise, injure their mine. The plant consists of five engines, aggregate 127 horse-power; six puddling machines, two buddles, three sluices, and pumps. The total cost of the plant is £13,500. The value of the gold obtained by this company is £207,733. 0s. 8d.; the amount of dividends paid is £131,000; and the amount of calls paid is £2,000. The first gold was obtained on the 6th September, 1866. The surface works are lighted by means of gas. The richness of the ground opened up by the Sir William Don Company, and the then general belief that it would not be found to extend any great distance beyond that company's claim, created an extraordinary demand for land for mining purposes in the vicinity of the claim; in some cases large sums of money were paid for the right to mine upon a residence area (say one-eighth of an acre in extent); and if the right to mine under a few adjoining areas was obtained, a company was at once formed, and large sums of money expended in the purchase and erection of machinery and the sinking of shafts, and the owners of private property in the locality realized large sums of money by the formation of companies to mine upon such property. As a natural consequence, many of these ventures proved failures, in some cases owing to the very limited extent of the ground which they had the right to undermine. In consequence of a decision of the Chief Judge of Courts of Mines (case *Sir William Don Company v. Koh-i-noor Company*), it was discovered that the Sir William Don Company's title to that portion of their claim within the Cricket Reserve was defective; and several of the companies having drives in the immediate neighborhood of it, drove under the Reserve. This led to a series of disputes, which were finally settled by a Royal Commission appointed to ascertain and determine the rights of the several parties contending for the right to undermine the Reserve; the Commission having determined that the Reserve should be apportioned amongst the several companies, it was agreed amongst these companies that a new company should be formed under the style of the Cricket Reserve Company, and that the shares in such company should be allotted amongst the several companies, in accordance with the decision of the Royal Commission.

The Cricket Reserve Company was formed on the 23rd July, 1867, and having purchased the shaft and plant of the Privateer Company, and the plant of the Golden Corner Company, commenced operations forthwith. Since then they have obtained gold to the value of £25,006 19s. 4d., and have paid dividends amounting to £12,500. The plant consists of three engines, aggregate sixty-two horse-power, and four puddling machines. The wash in this claim is over 400 feet in width, and from three feet to twenty feet in height. It is chiefly quartz-gravel, but there are large quantities of cement containing gold.

The Newington Freehold Company was formed in the month of March, 1866, to mine certain freehold property west of the Cricket Reserve and south of Eyre-street. A shaft has been sunk near the corner of Eyre and Pleasant streets, to a depth of

290 feet, about fifty feet of which is in bed-rock. The time occupied in sinking was sixteen weeks. A main level was opened at a depth of 280 feet, and monkey-shafts are put up at convenient distances apart into the wash, which is 260 feet deep. The wash is 450 feet wide, and from four to ten feet in height. The wash is a coarse gravel, and the bed-rock is soft sandstone and slate. The plant consists of two engines, aggregate sixty horse-power, and six puddling machines. The surface works are lighted by gas. The value of gold obtained is £111,444 4s. 9d.; the amount of dividends paid is £51,000; and the amount of calls made is £7,375.

The Newington Estate Company, being an off-shoot from the Newington Freehold Company, was formed in the month of November, 1866, for the purpose of mining the southern portion of the property held by the Newington Freehold Company. The Newington Estate Company spent a large sum of money in the purchase and erection of machinery, and the sinking of a shaft, and driving in search of a lead or wash; but they met with no success, and were compelled for want of funds to desist from further prospecting the ground, although some are of opinion they would have been rewarded had they been able to prosecute their works. The plant was sold off under execution about the month of September, 1867.

The Ballaarat Freehold Company was formed on the 12th April, 1866, for the purpose of mining a piece of private property situate west of Pleasant-street and east of the Victoria-parade. They sunk two shafts, one 285 feet deep, through 164 feet of rock, 44 feet of fine sand, and 77 feet of bed-rock; the other, 290 feet deep, through 164 feet of rock, 49 feet of fine sand, and 77 feet of bed-rock. The time occupied in sinking the two shafts was twelve months. They had a great quantity of water while sinking, having raised as much as 27,600 gallons per hour. They opened main levels from both shafts at a depth of 275 feet, and they reached the wash, the depth of which is about 250 feet, by means of monkey-shafts. There does not appear to be any gutter in this mine, but a general wash of very loose gravel, with large quartz boulders. The height of washdirt varies from two to eight feet; the bed-rock is soft slate and pipeclay. The plant consists of five steam engines, the aggregate power of which is ninety-two horse-power, and eight puddling machines. The value of gold obtained is £79,294 15s. 1d.; the amount of dividends paid is £22,500; and the amount of calls paid is £17,962 10s.

The Western Freehold Company was formed on the 23rd of April, 1866, for the purpose of mining that piece of private property situate on the eastern side of and adjoining the Public Park. They sunk a shaft 270 feet deep, through 146 feet of rock, 23 feet of clay, 60 feet of drift and washdirt, and 41 feet of bed-rock. They opened the main level at a depth of 270 feet, and reached the wash, which is 230 feet deep, by means of a blind shaft. The width of the wash is 400 feet, and the average height of washdirt is seven feet. The time occupied in sinking the shaft was eight months. The surface works are lighted by gas, and water is used for ventilating the mine. The plant consists of two engines, aggregate eighty horse-power, and six puddling machines. The gold is finally separated from the earth by means of a sluice. The value of the gold obtained is £70,231 18s. 4d.; the amount of dividends paid is £30,000; and the amount of calls made is £8,125.

The Southern Freehold Company was formed on the 25th October, 1866, for the purpose of mining that piece of land situated on the east side of the Victoria-parade, and between the claims of the Western Freehold and Ballaarat Freehold Companies. They sunk a shaft near the Victoria-parade to a depth of 252 feet, and put in a main drive about 600 feet; some portion of the drive is through washdirt, which is taken

from the face, and another portion is through bed-rock; and the wash above is reached by means of jump-ups or blind shafts. The average height of washdirt is from four to five feet. The time occupied in sinking the shaft was eighteen weeks. The strata sunk through were—135 feet of first rock, 40 feet of clay, 22 feet of second rock, 35 feet of drift and washdirt, and 20 feet of bed-rock. The bed-rock is soft slate; the washdirt is quartz-gravel, and appears to be a general wash of indefinite width. The plant consists of two engines, aggregate eighty horse-power, and six puddling machines. The value of the gold obtained is £36,674 14s. 5d.; the amount of dividends paid is £10,425; and the amount of calls paid is £8,750. This company was in existence only about one year, having, in the month of October, 1867, become incorporated with other companies as the Park Company.

The Park Company was formed on the 24th October, 1867, for the purpose of mining the Public Park Reserve, the shares in the Park Company being allotted amongst the several companies who, under the decision of the Royal Commission, were awarded permission to mine certain portions of said reserve. The company purchased from the Hand-in-Hand and Band of Hope Company the shaft sunk by that company in the Public Park, and the plant connected therewith, which now forms the Park Company's No. 1 shaft and plant; and they purchased from the Southern Freehold Company its plant and shaft, which now form the Park Company's No. 2 shaft and plant. The value of gold obtained by this company is £10,010 15s. 3d. No calls have been made, and no dividends have been paid. The plant is the same as purchased from the Hand-in-Hand and Band of Hope Company and the Southern Freehold Company. The Park Company finding the main drives too shallow to work the whole of the large area of ground they hold, especially the extensive wash to the westward, have sunk the No. 1 shaft seventy feet deeper, have cut two capacious chambers, and have opened a main drive in a westerly direction, which is now ninety feet in, principally through very hard reef. The wash has been proved by this company to a width of 400 feet, and in places the full width has not yet been ascertained. The wash appears to come in at the northern portion of the claim, where it is a wide-spread general wash, but in a south-westerly direction forms into several runs, which appear to be trending west by south.

Terrible Lead.—The Terrible Lead was traced from the head of Terrible Gully on the western slope of the Whitehorse Range. The gully was opened at the shallow end in 1855, shortly after the rush to the Magpie Gully. The wash in this gully was very rich, and extended a considerable width at the head, but lower down the gully it formed a regular gutter between two steep well-defined walls of hard sandstone reef. In many places the lead was not more than from eight to twelve feet wide; but generally there was a good height of washdirt, say about five or six feet. The claims were worked by means of windlass and buckets, and the quantity of water was so great towards the Yarrowee Creek, that it was with difficulty kept down with such appliances. The lead was not brought under the frontage regulations until it had been traced to the edge of the table-land. The first frontage claim was registered on the 1st July, 1856, and the survey of the last claims on the lead was made on the 16th August, 1856. There were only fifteen claims between the point at which the frontage claims commenced and the junction of this lead with the Whitehorse Lead. From the brow of the hill to the junction the dip of the lead was very great, and consequently that portion of the lead was very poor.

Frenchman's Lead.—About June, 1855, Magpie Gully was opened, and proved to be very rich. The run or lead was traced down the gully till it joined a lead from

another gully, known as Chinaman's Gully, which had been previously discovered, and which also was very rich. The trend of the lead after the junction was north-westerly till it joined the lead from the Frenchman's Gully, which had been opened long before. The lead from the last-mentioned point of junction was called the Frenchman's Gutter or Lead. The sinking in the gullies was chiefly through yellow clay and gravel; there were comparatively no difficulties to contend with in sinking, and the claims through which the lead passed were very rich. The Frenchman's Lead was traced round the side of a basaltic hill and down into the flat towards the Yarrowee Creek. The lead after the junction of the three leads or runs assumed the appearance of a deep lead, that is to say, black clay was found in sinking; the wash was a dark-colored gravel, the quartz being water-worn, and the gutter was well defined. As the lead was traced towards the Yarrowee Creek, it appeared to be trending into the table-land, but the miners would not believe that it could run in that direction on account of the basaltic rock; some thought it would follow the course of the creek, others that it would turn into the flat, and others that it would run out. These various opinions led to the sinking of shafts in various directions, which proved the lead was not trending in either of the directions supposed; and the shafts along the course of the lead finally proved that it passed under the creek at right angles to the course of the creek and so into the table-land. The depth at the creek is about 130 feet, and the height of the table-land above the level of the creek is nearly 100 feet. A number of claims were then marked off up the hill and on to the table-land; but the shafts were not sunk to any great depth for some time, owing partly to the want of appliances and want of experience in rock-sinking, and partly to the system of shepherding. In the same manner that formerly men who had gained any experience in sinking and timbering shafts through drifts had been in request, now men who had the slightest knowledge of blasting rock were eagerly sought for, and in many instances men who had never before even seen the operation, were compelled to set to work to sink through hard rock. The Frenchman's was the first lead to which the "frontage system" was applied, under regulations framed by the local court especially relating to that lead, and Mr. John Wall was appointed the surveyor of that lead. Sinking upon the table-land was not generally prosecuted with vigor until the frontage regulations came into force; but one party of Newcastle men, having more enterprize or possessing more skill than others, commenced a shaft on the table-land about forty yards from the brow of the hill, and had sunk to a depth of 130 feet before the other companies had fairly started. The shaft of this party proved beyond a doubt that two distinct layers of rock would be encountered in sinking, the second one containing an immense body of water, thus presenting a new and greater difficulty than any previously met with by the miner. The Newcastle party had done all that unaided labor could do towards overcoming the difficulties, and it was unanimously agreed by the miners on the lead that they should have the first place, and be protected as under the frontage regulations; consequently the parallels were laid off from and including their claim. The introduction of frontage claims was soon followed by the practice of uniting or amalgamating several claims under one management, and working on the co-operative principle. But owing to a prejudice then existing against the union of any large number of claims, the sanction of the local court had to be obtained. Of course one of the chief objects in uniting claims was that only one shaft should be sunk for the united claims; and it was thought that if too many claims were united, the shafts would be such a distance apart that one would not assist the other in baling the water, and that on that account the working of the lead would be delayed. In sinking on the

table-land near the brow of the hill, there were cut 160 feet of first rock; a deposit of very hard sandstone conglomerate, about twenty feet thick; a second layer of basaltic rock, containing a large quantity of water; a layer of grey clay; and a layer of black clay, so largely composed of vegetable matter as to resemble coal in appearance and structure. This black clay nearly always lies over the gutter, and used to be regarded by the miner as a certain indication that the shaft would bottom in or near the gutter. Specimens of this clay were found bearing the exact impression of a leaf resembling that of the peppermint-tree; pieces of wood and trunks of trees were also found in or below the black clay, and at the point of junction of the Frenchman's and Whitehorse Leads, the trunk of a tree was found standing in its natural position. The trunks of trees when found generally retained their original form, but they were so completely decomposed that they crumbled to dust as soon as they were exposed to the air. So far as I can learn, no trace has ever been found in this locality of trees or other vegetable life in or between the several layers of rock. The third rock was first found at a depth of 220 feet, in a shaft sunk by the Equitable Company, on claim No. 35; and the fourth rock was first seen in the shaft sunk by the Redan Company, on claims 48 to 51. In the Cumberland, Durham, and Cornish Company's claim, Nos. 62 to 70, the third layer of rock was much harder and more difficult to sink through than any previously discovered. The junction of the Frenchman's and Whitehorse Leads was found on the 8th June, 1857; and from the point of junction only about 2,400 feet in length of the gutter has been worked out since that date. The width of the Frenchman's gutter has varied from eight feet to 400 feet. Some years since an estimate was made of the cost of working and the value of gold obtained from 2,566 feet of the gutter, when it was found that the cost of working was £37,000, and the value of gold obtained was £127,729, being equal to nearly £50 per lineal foot.

The holders (twelve in number) of claim No. 1, known as the Newcastle Party, sunk a shaft 240 feet deep, and drove a distance of 170 feet through bed-rock before reaching the gutter; they were engaged eight months in sinking the shaft and driving out the gutter. The amount of dividends paid was £4,185, and the cost of materials and works, exclusive of labor, was £450.

The holders of claims Nos. 2 and 3 (twenty-four in number) were occupied nine months in sinking the shaft and working out the claims. The amount of dividends paid was £6,260, and the cost of works, &c., was £718.

The holders of claims Nos. 4 and 5 were ten and a-half months sinking the shaft, driving 110 feet to the gutter, and working out the gutter. The dividends paid amounted to £6,250, and the amount expended was £536.

The holders of claim No. 6, known as the Black Flag Company, were very little more than seven months in sinking the shaft, driving 130 feet, and working out the gutter. The amount of dividends paid was £4,050, and the amount expended was £700.

The holders of claims 7, 8, and 9, known as the Yankee Company, sank a shaft 275 feet deep; the strata sunk through being twelve feet of surface soil, eighty feet of first rock, thirty feet of clay, ninety-seven feet of second rock, thirty feet of clay, twenty feet of drift, six feet of gravel intermixed with clay. The distance from the shaft to the gutter was 270 feet, the width of the gutter twenty feet, the height of washdirt five feet; and the reef was generally hard. The claim was worked by means of windlass and buckets; thirty-two-gallon buckets being used for baling. At one time the quantity of water was so great, that twelve men working constantly night and day for six weeks could not keep the water down. The amount of dividends

paid was £9,000, and the amount expended was nearly £700. The length of time spent in sinking the shaft and working out the claim was seven and a-half months.

The holders of claims Nos. 10 to 12, known as the Twelve Apostles Company, sunk their shafts, drove to the gutter, and worked out their claim in about eight months. The amount of dividends paid was £12,000, and the amount expended was £2,000.

The holders of claims Nos. 13 and 14 were engaged ten months in sinking shafts, driving to the gutter, and working out the claim. The amount of dividends paid was £3,700, and the sum expended was £710.

The holders of claims Nos. 15 to 19, known as the Co-operation Company, spent twelve months in sinking shafts, driving to the gutter, and working it out. The sum divided was £9,100, and the amount expended was £1,000.

The holders of claims 20 to 22, known as the Alma Company, were engaged ten months in sinking the shaft, driving from the shaft 210 feet to the gutter, and working out the gutter. The amount of dividends paid was £9,000, and the sum expended £900.

The holders of claims No. 23 to 27, known as the Enterprise Company, spent eighteen months in sinking shafts, putting in main drive 370 feet to the gutter, and working out the claim. They expended £3,050, and divided £19,500.

The whole of the foregoing claims were worked upon the co-operative principle, each shareholder working his share, so that the expenditure given is exclusive of labor.

The claims 28 to 31 were held by the Hand-in-Hand Company. Claims 32 to 35 were held by the Equitable Company. The holders of claims 36 to 45 formed four companies, but they were known by no distinguishing name other than the numbers of their respective claims. Claims 48 to 51 were held by the Redan Company. Claims 52 to 55 by the Kangaroo Company. The junction of the Frenchman's and Whitehorse Leads was discovered in these claims. Claims 51 to 56 were held by the United Miners Company. Claims 62 to 70 were held by the Cumberland, Durham, and Cornish Company, who commenced work in May, 1856; the company consisted of 108 men. The cost of this company's works is set down at £27,000, and the yield of gold at £24,300. The manager of this company took some pains to collect information touching the yield of gold along the lead and the cost of working, and he found that the yield averaged £50 per lineal foot. He also ascertained that the yield from 2,566 feet in length of the Frenchman's Gutter was £127,729, and the cost of working it was £37,000. The claims 71 to 75 were held by the Leviathan Company. Claims 76 to 79 were held by the Bullock-horn Company; and claims 80 to 82 were held by the Nelson Company. Each of these companies commenced sinking in May, 1856, but were unable to proceed beyond a certain depth in consequence of the quantity of water in the rock, and the difficulty of obtaining sufficiently powerful machinery. In March or April, 1858, these three companies were amalgamated under the style of the Nelson Company. They sunk the shaft which was commenced by the original Nelson Company to a depth of 240 feet, but the water then overpowered them and they were unable to sink deeper; they therefore abandoned that shaft in 1859, and put on all their force to sink the shaft commenced by the Leviathan Company. They at length succeeded in bottoming this shaft on the 16th July, 1861, in the gutter. The washdirt at the bottom of the shaft was very rich, and yielded as much as 1 oz. to the tub. In May, 1862, the company discovered the Wellington Lead and took up a claim on it, and the style of the company was then changed to the Nelson and Wellington Company. On the 5th September, 1864, the company was registered under the Limited Liability Act. The value of gold obtained prior to the 5th

September, 1864, was £146,121 7s. The amount of calls paid to that date was about £6,000, and the amount of dividends paid to that date was £130,075 10s. Since the 5th of September, 1864, the value of gold obtained is £101,010 10s. 10d. The amount of calls paid is £1,127, and the amount of dividends paid is £43,954 13s. 5d. The depth of the lead is 384 feet, and the width varies from 100 feet to 300 feet. The plant consists of three steam engines, of 100 horse-power, and four puddling machines. After having worked out as much of the claim as could be reached conveniently from the No. 1 shaft, the company resumed the shaft which the Nelson Company originally commenced sinking and afterwards abandoned; and they have recently bottomed it, and are now working the wash at the deeper end of their claim. Before abandoning the No. 1 shaft they opened out into the country between the third and fourth layers of basaltic rock at a depth of 280 feet, and drove a distance of 270 feet through sand, gravel, and clay, but could not find any ground that would pay for working; they are, however, of opinion that the wash, if followed to the reef, would be found to pay for working.

The claims 83 to 86, 87 to 90, 91 to 93, and 94 to 98, were respectively held by separate companies, each of which commenced to sink shafts in the months of June or July, 1856, and continued sinking separate shafts until the 13th December, 1859, when they were amalgamated, under the style of the Working Miners Company; and on the 26th December, 1857, they commenced their present shaft on claim No. 92. In April, 1859, they had to put down pumps; and about November, 1861, they bottomed the shaft. The strata sunk through were 74 feet of first rock, 8 feet of clay, 118 feet of second rock, 3 feet of rotten rock, 78 feet of third rock, 29 feet of clay and drift, 77 feet of fourth rock. They have since then sunk the shaft in the bed-rock, and the total depth of it is about 450 feet. The depth of the gutter is about 390 feet, and the width varies from 100 feet to 150 feet; the bottom is slate and sandstone. Cages were first used in this mine on the 23rd December, 1861. They did not reach the gutter till the end of September, 1866. The value of the gold obtained is £81,196 4s. 4d.; the amount of calls paid is £82,800; and the amount of dividends paid is £25,200.

The claims 99 to 114 were held by the Evening Star Company, but were abandoned by that company, and were taken up by the United Working Miners Company. The claims 115 to 122 were taken up by the Albion Company, who commenced boring for the deep ground. This company was the first to attempt boring on the table-land, and the process was found both expensive and tedious on account of the quantity and hardness of the basaltic rock. When they had ascertained the position of the deep ground, they commenced on the 4th June, 1858, to sink the shaft. The strata sunk through were—clay 5 feet, rock 93 feet, clay 8 feet, rock 154 feet 6 inches, clay 1 foot 6 inches, bed-rock to bottom of well 213 feet; the total depth of the shaft being 475 feet. The width of the gutter varies from 70 feet to 400 feet, and the height of washdirt from one foot to six feet. The quantity of washdirt raised per day is 350 tons; the average amount of wages paid per week is £838; and the average weekly cost of materials is £200. The value of the gold obtained from the mine is £254,144 16s. 6d; the amount of calls paid is £117,995 5s; the amount of dividends paid is £90,921 15s. The plant consists of four steam engines (aggregate 118 horse-power), six puddling machines, and two buddles.

Whitehorse Lead.—From the Whitehorse Gully, situate on the western slope of the Whitehorse Range, a shallow run was traced during the early part of the year 1854, to the foot of the gully, where it was supposed to have run out, or to be so

poor as not to be worth working; consequently the lead or run was abandoned for about two years. Shortly after the registration of the Frenchman's Lead under the frontage regulations several prospecting parties took up claims to search for the lead, and discovered it. The enterprize of some of the prospectors near the Yarrowee Creek proved that the gutter still yielded gold in paying quantities, and application was forthwith made to have the lead placed under the frontage regulations. From the point where the lead was discovered it was traced back towards the point where it had been lost at the foot of the gully. In this direction it was dipping so fast that, except near bars of reef—of which there were a great many across the gutter—the washdirt was very poor. In the opposite direction, that is to say, along the trend of the lead, it was traced from the creek under the table-land, through a line of frontage claims. When the Whitehorse Lead had been brought under the frontage regulations, it was determined that it and the Frenchman's should be placed under the supervision of a joint committee. The first registration of frontage claims on this lead was made on the 13th of May, 1856, and the greater part of the claimholders at once commenced sinking their shafts. There were eighty-two claims taken up, of which No. 1 was worked by itself, Nos. 2 and 3, 4 and 5, 6 and 7 respectively were amalgamated. The holders of Nos. 8 to 10, amalgamated, were known as the Swiper's Mob. While sinking through the drift which lies between the first and second rocks, at a depth of from forty feet to sixty feet, gold was seen. They washed some of the drift in a tub by way of test, and obtained a small quantity of coarse gold, but the drift was not sufficiently rich to induce them then to work it. The person who made the discovery states that he intends to prospect it thoroughly. The depth of the gutter in these claims was about 210 feet, and the gutter was within ten feet of the shaft. Nos. 11 to 13 were amalgamated. Nos. 14 to 16, amalgamated, were held by the Royal Charter Company. Nos. 17 to 19, amalgamated, were held by the Victoria Company. Nos. 20 to 22 were held by the White Star Company, whose shaft bottomed on the reef. They drove 219 feet, and put down a blind shaft alongside the gutter, which they struck in November, 1856. While working this gutter they, in January, 1857, discovered the junction of the Terrible Lead with the Whitehorse Lead. Claims 23 and 24 were held by the Flying Dutchman Company. Nos. 25 and 26 by the Champion of the Seas Company. Nos. 27 to 29 by the Opossum Company. Nos. 30 to 32 by the Heart and Anchor Company, who reached the gutter on the 8th December, 1856. Nos. 33 to 39 were held by the Leviathan Company. Nos. 40 to 44 were held by the Eldorado Company. The junction of the Frenchman's and Whitehorse Leads was found in the claims of this company and the claims of the Kangaroo Company, situate on the Frenchman's Lead. Claims 45 to 48 were held by the Pilot Company. Nos. 49 to 53 were held by the Tam o'Shanter Company. Nos. 54 to 58 by the Golden Horn Company. Nos. 59 to 64 by the Red Jacket Company. Claims 65 to 70, 71 to 76, and 78 to 82 respectively were amalgamated, and work was commenced upon them, but was afterwards abandoned, and the claims were taken up by the Red Jacket Company. The Red Jacket Company commenced sinking in May, 1856, and obtained gold in August, 1859. The depth of the shaft is 400 feet, the strata sunk through being 70 feet of first rock, 20 feet of greasy clay and rotten rock, 100 feet of second rock, and 210 feet of bed-rock. The width of the gutter was forty feet. After this company reached the gutter, a dispute arose between this company and the Nelson Company, in consequence of which the greater part of the claim was worked out under the direction of a manager appointed by the Court of Mines, and the proceeds from the sale of the gold

were paid into court pending the settlement of the dispute. Shortly after the disputed territory had been worked out a new lead was discovered, which was afterwards proclaimed the Wellington Lead, and a new company, known as the United Red Jacket Company Registered, was formed in September, 1864, to work a claim thereon. The Wellington Lead, which is a tributary of the Frenchman's Lead, was traced by the United Red Jacket Company, from the point at which it was discovered by said company to its source on a reef lying between the Albion and St. George Companies' claims, where an extensive spread of washdirt was found. Although there was a great height of washdirt at the source of this lead, it proved, after repeated trials, to be non-remunerative. Having blocked out the whole of the gutter within their claim, they prospected the reefs in a north-easterly direction, but no new discovery was made. They have now suspended operations. The value of gold obtained from the Wellington Lead was £64,772 9s. 9d.; the calls paid amounted to £107,904 10s.; and the dividends paid amounted to £14,300. The plant consists of two steam engines, aggregate thirty-six horse-power, three puddling machines, and one buddle.

Cobbler's Lead.—The Cobbler's Lead was traced from a gully in the range known as Cobbler's Gully, which was opened about the beginning of the year 1855. Some of the claims were very rich at the shallow end of the lead; but towards the Yarrowee Creek they did not pay so well. At the upper end of the gully the lead was narrow and the reefs steep and well defined, but towards the lower end the lead was wider and the reefs less steep. The sinking was chiefly through yellow clay, and a mixture of fine sand and clay drift, which was most difficult to sink through when the water got into it, consequently many of the shafts were lost either in sinking or in opening out. As the lead spread out it became poorer, and many of the claims at the lower end of the gully did not pay for working. About the beginning of 1856, a party commenced on Mr. Winter's private property, at the western side of the creek, to prospect for the continuation of the lead, and after a considerable time, viz., in the month of October, 1856, discovered it. In the meantime, three other prospecting parties, two within private property and one on Crown lands, had commenced to search for the lead, and finally the lead, having been discovered by the party prospecting on Crown land, was proclaimed a frontage lead, and the Prince of Wales Company was registered for the first claims on the 24th October, 1859.

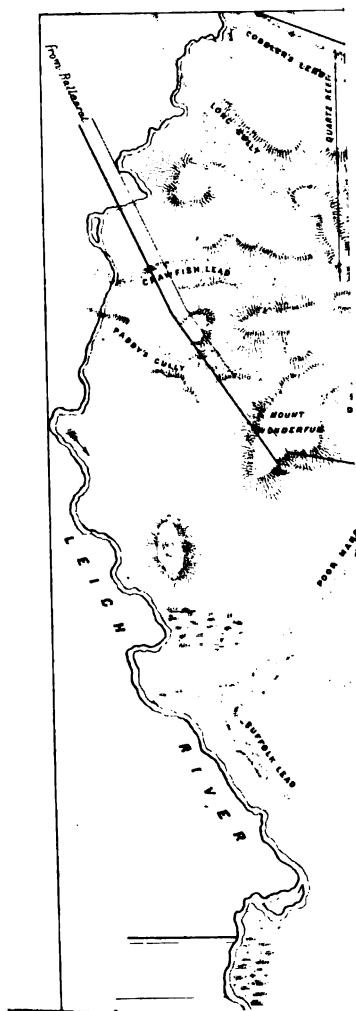
The Prince of Wales Company (the only company on the lead) commenced to get gold in 1862; up to that time they were engaged in sinking the shaft and driving for the gutter. Nearly four years were spent in sinking the No. 1 shaft, the depth of which is 387 feet. The strata sunk through are six feet of clay, seventy feet first rock, one foot light clay, eighty feet of second rock, two feet of black clay, sixty-eight feet of third basaltic rock, thirty feet of clay and drift, forty feet of fourth rock, thirty-five feet of loose drift, and fifty-five feet of bed-rock. The shaft is seven feet by four feet, divided into two compartments by three-inch centres. One compartment is used for winding only, the other for pumping and winding. The first plant erected on this claim consisted of a vertical engine, fifteen-inch cylinder, thirty-inch stroke crank over head, a nine-inch lift of pumps; two wooden puddling machines, fourteen feet in diameter and two feet deep, driven by the engine by means of a belt; and a large cradle, also driven by the engine, for the purpose of washing off the dirt after puddling instead of sluicing. While sinking the shaft, it was found necessary to erect another engine for winding only, and for this purpose a beam engine, ten-inch cylinder, two-feet stroke, was erected. Since then all the surface works have been altered, and the plant now consists of a horizontal winding engine, twenty-two and a-half inch cylinder,

five-feet stroke, which winds on the first motion or fly-wheel shaft. The rope used is six-inch flat Manilla rope. The cages are constructed to carry two trucks at once, one above the other. The cage is raised about thirty feet up the shaft by one stroke of the engine, and is raised from the bottom of the shaft to the surface in thirty seconds. The brace on the surface and the chamber below are so arranged as to change both the trucks at one time without moving the engine. The average number of trucks raised per diem of twenty-four hours is 1,500; but on an emergency a much larger number is raised. The winding engine is supplied with steam from the boilers of the pumping engine. The pumping engine is twenty-four-inch cylinder, horizontal four-feet stroke. There are three Cornish flue boilers, two thirty-five feet long by seven feet diameter, and one twenty-six feet long by six feet six inches diameter. The engine works fourteen-inch lift of pipes with plunger and draw-lift to pump the water from below. It also works a battery of sixteen square stamp-heads, three puddling machines, and a sludge machine. There is one main sluice with two sluice-heads, for sluicing the dirt after it has been puddled. They have another battery of forty rotary stampers, or four separate batteries of ten stampers each, five stampers in each box; each stamper and lifter weighs about 6 cwt. Each battery is worked with tooth-wheels, connected with main driving shaft and clutches with levers, so as to work the whole battery or any part of it as required. The shafting and lifters are turned; the discs and wipers are steel-faced. The discs are screwed on to the lifters, so as to raise or lower them as required. The boxes have circular fronts to correspond with the stampers, and to give the gratings larger area for discharge. There are two silver ripples, and blanket surface about twenty-four feet long. There are four bands which can be worked together or separately, for amalgamating the gold washed from the blankets; and two shaking tables are used for separating the dirt from the silver after taking it from the barrels. Four boys are employed to feed the batteries by hand. This battery is driven by a horizontal engine, twenty-five and a-half inch cylinder, four-feet stroke, with three Cornish flue boilers, each twenty-six feet long by six feet six inches diameter. Connected with the battery engine there are four eleven and a-half inch plungers—two for lifting the water and sand as they come from the stampers into shoots, which are fixed about forty feet above the surface. The sand runs about 400 feet or 500 feet along these shoots, where it is allowed to settle, the water running into a settling dam, from which dam the water is again lifted by the other two plungers, so as to be used again for the batteries and other surface works. There is a smelting-house connected with the works, in which there are three furnaces—one for smelting gold, and two for retorting silver. The works at the No. 2 shaft have been stopped for a considerable time, and a portion of the plant has been removed from it. The plant consisted of a horizontal engine, twenty-five and a-half inch cylinder, four-feet stroke, used for pumping and driving; two iron puddling machines; one winding engine, eighteen-inch cylinder, three feet six inch stroke; and three Cornish flue-boilers, twenty-six feet long by six feet six inches wide. The No. 3 shaft is ten feet six inches long by three feet eight inches wide, and is divided into three compartments, two of which are used for winding, and the third is used as a pump shaft and for the timber cage. The depth of this shaft is 410 feet 6 inches, and the strata sunk through are fifty-five feet of first basaltic rock, seven feet of clay or mud, twenty-one feet of first basaltic rock (the first layer of basaltic rock in this shaft is divided by a layer of clay or mud seven feet in thickness), fifteen feet of brown clay, seventy-three feet of second basaltic rock, twenty-one feet of clay, sixty-six feet of third basaltic rock, twenty-two feet of drift

and conglomerate containing water-worn flint stones or the like, four feet of washdirt containing gold, and 126 feet 6 inches of bed-rock to the bottom of the well. The chamber or plat is opened out at a depth of 400 feet, and the deepest portion of the gutter worked from this shaft is 370 feet below the surface. Although the shaft is only 220 feet from the gutter, the bed-rock was touched in the shaft more than eighty feet above the level of the gutter and although the fourth layer of basaltic rock is found immediately over the washdirt in the gutter, it was not met with in sinking the shaft. The time occupied in sinking the No. 3 shaft was fifty weeks. The plant at this shaft consists of a horizontal pumping engine, twenty and a quarter-inch cylinder, four-feet stroke, which works an eight-inch plunger and draw lift, for pumping water from the mine; four iron puddling machines, two sludge machines, an amalgamating barrel; a centrifugal pump, for lifting water from the surface to the tanks, about thirty-five feet high, for the puddling machines, &c.; and one ten-inch drawing lift, for raising waste water into the main dam. There is one engine, twelve horse-power, for sending timber down the shaft, and for raising or lowering pitmen. One double cylinder vertical winding engine—cylinders fourteen and a-half inches diameter, three-feet stroke. This engine is fitted with four slide valves, worked by link motion, and is supported by two cast-iron stands. The winding gear takes up about thirty feet to one revolution. The ropes used are flat wire, four and a-half inches by three-quarters of an inch. The cage is made to carry two trucks, one above the other, and the weight of the two trucks of washdirt and the cage is about 35 cwt. There are only one stage and one flat, where the trucks are put into the cage; consequently, after the first truck has been put into the cage, the cage has to be moved before the other truck can be put in; for this purpose the cage has to be moved to a great nicety, which can be done by means of the two cylinders, the cranks being on the quarter prevent any centering. The engine works two strokes to one round of the winding gear, and the time occupied in bringing up the cage containing two trucks of dirt is about forty seconds. A self-acting alarm-bell is attached to the winding-gear, and the engine-driver is placed at such a height that he has a full view of the cages when they arrive at the top of the shaft. There are two Cornish flue boilers about twenty-six feet long by six feet six inches diameter, made of seven-sixteenth inch plate in case and tube, half-inch plate in the ends; the tubes are strengthened with angle-iron rings, and two small domes over the fire-place are raised about two and a-half inches above the surface of the tube, with lead plug set in with the view of preventing explosion in the event of the water getting low. The four cast-iron puddling machines are fixed so as to form a square; each machine is sixteen feet six inches diameter, and two feet six inches deep. They are worked by means of Hunt and Opie's patent chain and pulleys. Above the machines is a stage, or platform, connected with the brace, which is about forty feet above the surface, and upon this platform the trucks are run to and the dirt emptied into the machines. In the bottom of each machine there are two cast-iron doors about one foot six inches by two feet, hung so as to open below, for the purpose of cleaning them out. These doors are fastened with four screws, and when the machines have been filled, and the dirt sufficiently puddled, the doors are opened from below, a harrow and scrape are attached to the machinery, and by means of these the dirt is cleaned out of the machine, through the doors, in about thirty minutes. Below the machines is the sluice-house, where there are four sluice-heads, one under each of the machines; these sluice-heads lead into the centre or main sluice. The dirt, when puddled, falls through the holes, or doors, in the bottoms of the machines close to the sluice-heads, so that the men can conveniently

feed the sluice. In the centre sluice is a fork worked by machinery, for the purpose of separating the dirt. The four machines are tended and cleaned out by two men in each shift, and all the dirt is sluiced during day time by two men and one boy. The stones taken from the machines as the dirt is puddled, are passed through the centres of the machines, so that no trucks or barrows are required on the machine floor. The two iron sludge machines are about fourteen feet diameter, and two feet deep; the sludge, as it leaves the puddling machines, passes into them, and the sand taken from these machines is passed through a sluice and over a blanket surface; the stuff washed from the blanket is put through the amalgamating barrel. On a stage a little above the machines are fixed ten 400-gallon iron tanks coupled together; and the water is lifted into the tanks by the centrifugal pump. Connected with the tanks are pipes leading to each machine, sluice-head, and sludge machine; to these pipes are stop-valves and cocks, so as to let on the water as required. Near this plant is a large dam, the embankment of which is 700 feet long, fifteen feet high at the deepest point, and about twelve feet wide on the top. From this dam the water is laid on in iron pipes to each of the three shafts. The width of the gutter varies from 30 to 110 feet; what is called the gutter in this claim is that portion only of the wash which is immediately under the fourth layer of basaltic rock. The average width of the payable ground, taking both gutter and reef-wash, is 260 feet. The height of washdirt varies very much; in some places it is four feet, in others the basaltic rock is close to the bed-rock; and in the last-mentioned places the auriferous gravel is found in greater quantities on the reef. The washdirt in the gutter is quartz and sandstone boulders, very much water-worn, intermixed with sand, black clay, charred wood, &c. The washdirt on the high reefs is chiefly stiff brown clay, intermixed with quartz, less water-worn than in the gutter; large quantities of iron pyrites and mundic are also found. In the bed-rock, the layers of which run north and south, is found a well-defined "fault," composed of soft granite or the like, and quartz leaders are also found. The quartz lode in this claim varies in width from eight feet to twenty feet, and it has a well-defined wall to the west; the underlie is to the east, at an angle of twenty degrees. They have already sunk 100 feet below the cap of the lode, and find the quartz highly auriferous, the gold being well distributed throughout the lode. The cost of the plant is £36,792 15s. 9d.; the quantity of firewood used annually is about 4,000 cords of 128 cubic feet each; the weekly expenditure for timber, firewood, ironmongery, wear and tear, &c., is about £180; the weekly expenditure for wages is £1,050; the quantity of gold obtained from the mine is 80,249 ozs. 9 dwts. 8 grs., which was sold for £322,558 7s. 6d.; the amount of calls paid is £13,961 11s. 8d.; the total amount of dividends paid is £162,094 8s. 4d. The quantity of washdirt raised per diem of twenty-four hours is at least 800 tons, including quartz, &c. This company has been in the habit of crushing washdirt instead of puddling it, and they find the cost of crushing considerably greater than puddling, except where any large proportion of the washdirt is cement, but they also find that more of the fine gold can be saved by crushing than by puddling.

Paddy's and Crawfish Lead.—A company, now known as the Alston and Wear-dale Company, sank a shaft on the western side of the Yarrowee Creek, for the purpose of searching for the continuation of the Paddy's Gully and Crawfish Lead. The shaft bottomed on the reef; they sunk a certain distance in the reef or bed-rock, and not knowing at what depth the lead would be found, they cut a prospecting drive through the bed-rock in search of the deep ground; as soon as this drive broke through, it came against the second layer of basaltic rock. They then sunk a blind shaft a certain



depth, and put in a drive which broke through into what appeared to be washdirt, viz., a coarse drift containing gold. The lead so discovered was proclaimed the "Prospect Lead" under the frontage regulations, and several claims were taken up and registered upon it. When they came to work this so-called lead, they found a layer of basaltic rock under the washdirt. They washed a considerable quantity of the dirt and found it paid for working, but they knew it could not be the lead on account of the third layer of basaltic rock being found under it; they then sunk the shaft deeper and discovered the lead for which they were searching.

The Buninyong Company.—The Buninyong Company occupies the land shown on the accompanying plan, and formerly known as Learmonth's pre-emptive right. The company commenced operations on the 23rd November, 1867. They have sunk nine shafts, two of which have been used merely as prospecting shafts, one of them having been worked by means of a horse-whim, and the other by means of a whip. The other seven shafts have been extensively worked by the aid of steam-power. The positions of the several shafts are marked on the plan. The No. 1 shaft, situate near the north-west angle of the land, was sunk through 45 feet of alluvial clay, 40 feet of basaltic rock; 15 feet of clay, 27 feet of bed-rock. From it they drove through bed-rock into the Scotchman's Gutter, the depth of which at that point is 125 feet. The No. 2 shaft is south of the No. 1 shaft. It was sunk through 24 feet of clay, 65 feet of basaltic rock, 42 feet of clay and gravel, and 49 feet of bed-rock. Drove through bed-rock to the gutter, the depth of which at that point is 168 feet. The No. 3 shaft was sunk at the south end of the land, and near the south-west corner. The strata sunk through were 18 feet of loam and clay, 85 feet of basaltic rock, 8 feet of clay and sand, 165 feet of second basaltic rock, 12 feet of sand and gravel, 19 feet of bed-rock; depth of shaft 307 feet. The depth of the gutter at this point is 297 feet. The gutter is formed by the union of the Scotchman's, Union Jack, Stone-quarry, Sodawater, Devonshire, and Goldseeker's Leads, with the Franklin Lead coming in from the west. The No. 4 shaft is situate south-east of No. 1 shaft and north-east of No. 2 shaft. It was sunk through 30 feet of alluvial soil and clay, 45 feet of basaltic rock, 20 feet of clay; bottomed at 95 feet; was sunk 55 feet in bed-rock, and a drive was cut through bed-rock into the gutter, the depth of which at that point is 145 feet. The No. 5 shaft is situate south-east of the No. 1 shaft and north of No. 4 shaft. The No. 6 shaft is south of the No. 2 shaft, north of the No. 3 shaft, and about midway between them. It was sunk through 5 feet of clay and alluvial soil, 45 feet of basaltic rock, 5 feet of brown clay, 6 feet of gravel, 207 feet of bed-rock; depth of shaft 268 feet. They drove eastward 1,000 feet, and broke through 22 feet above the gutter, the depth of which at that point is 286 feet. There was a rise of four feet in the length of the drive. They then cut an incline thirty-six feet deep, and fixed an engine underground to work the trucks. The gutter includes the Scotchman's, Union Jack, Stone-quarry, Sodawater, and Devonshire Leads. The No. 7 shaft is south of the company's land, on the Victoria Lead, near the River Leigh. It was sunk through 45 feet of alluvial clay, 56 feet of basaltic rock, 9 feet of clay and gravel, 15 feet of bed-rock. Opened out at 125 feet and drove to the gutter, which was found to be fourteen feet deeper than the drive, viz., 139 feet. They worked the gutter for some time by means of an incline, and then sank the shaft to a depth of 172 feet; they opened out at that depth, and drove into the gutter towards the junction of the Welshman's Lead, where they are at present working. They afterwards sunk the shaft to a depth of 266 feet, and drove for the main lead, which is being worked from the No. 3 shaft, but never reached it. The Victoria Lead, after being joined by the Welshman's Lead, held an

easterly course and joined the Durham Lead, which empties into the Main Lead. The No. 8 shaft is near the north-east corner of the land, and near the junction of the Devonshire Lead with the Sodawater and Stone-quarry Leads. The No. 9 shaft is that situated south of the No. 2 shaft and north of the No. 6 shaft. It was sunk through 13 feet of clay, 20 feet of basaltic rock, 56 feet of clay, 68 feet of basaltic rock, 54 feet of red and black clay, and bottomed at 211 feet in the Scotchman's Gutter.

The Main Lead, formed by the junction of the Durham, Victoria, Franklin, Scotchman's, and other leads, has been traced, with the exception of the two small breaks between the National shaft and the Great Britain, and between the Great Britain shaft and the John Bull shaft, in an unbroken line to the Garibaldi Company's claim. The last claim in the direction of Shelford in which the Main Lead has been actually worked, is the City of Manchester Claim. The Leigh Grand Junction Company is the nearest to Shelford on the Main Lead; but they have not yet actually worked the lead though they have bottomed, and their drive is supposed to have just reached the edge of the gutter.

The Chryseis Company sank a shaft for the Main Lead on the banks of the River Leigh. The basaltic plateau through which the lead trends rises 220 feet above the mouth of the shaft; the object in sinking the shaft in that position was to avoid so great a thickness of rock, which in that locality is very hard to sink through. The result was that they had only 72 feet of rock and 12 feet of alluvial to sink through before bottoming; they then sunk 126 feet in the bed-rock, and drove to the gutter, but they have never been able to work the gutter on account of the quantity of water in the mine. Since they reached the gutter they have been swamped out some eighteen months. During six months of the time a stream of water, equal to a ten-inch column, has been running over the mouth of the shaft, and at the present time the stream of water running from the mouth of the shaft is equal to a three-inch column. By the aid of very powerful machinery and large pumps they were for a time able to keep the water down, but were never able to work the mine profitably. It is the opinion of some practical miners, that when the water shall have drained from the rock of a higher level than the mouth of the shaft, the company will be able to resume work.

RAISING WASHDIRT, ETC.

In the earliest days the surface to a certain depth was scraped or shovelled up and washed, but as the depth of sinking increased the earth overlying the washdirt was found to be non-auriferous; and as it was therefore necessary to keep the washdirt separate from the refuse, the plan was adopted of filling it into bags or buckets, and pulling it to the surface by means of a piece of rope fastened to the bag or bucket. In some cases, where shallow ground was worked by the process known as "paddocking," stages or platforms were erected one above another, and the washdirt was thrown with a shovel from one stage to another till it reached the surface; and some of these paddocks were baled by men placed on these several stages, passing up the water in buckets from one to another. After a time the wooden windlass, (i.e. composed entirely of wood) was introduced. The frame was constructed of sticks fastened together somewhat in the form of a sawing-horse, or consisted of three poles fastened together at the top. The barrel was a straight piece of round timber, about six or eight inches in diameter, having grooves cut in it to work in the frame, and the handle was made of a crooked limb fitted into a groove cut at one end of the barrel; a rope was made

fast to the barrel, and the forked portion of a branch of a tree—as nearly as could be found resembling a hook—was made fast to the other end of the rope. By means of this apparatus the washdirt filled into bags or buckets was raised to the surface. As these windlasses were not always sufficiently strong to bear the weight of a man, the men used to ascend and descend the shafts by means of footholes cut in the opposite sides of the shafts, which were usually round or oval. The next appliance for raising dirt, &c., was the German lever or whip, which consisted of a sapling made fast by a rope to an upright, and to the thin end of the sapling was attached a rope with a hook; to the thick end of the sapling was fastened a log or other heavy substance, to counterbalance the weight of the bucket of dirt; the man on the surface pulled down the thin end of the sapling, and thereby lowered the rope into the hole, and when the bucket of dirt had been hooked on by the man in the hole the man on the surface, with the help of the weight on the thick end of the sapling, was able to raise the bucket of dirt with ease to the surface. These whips were chiefly used to raise dirt from “paddocks.” The next improvement was in the mode of constructing the windlass frame or stands, which were made of slabs of wood fitted perpendicularly into a solepiece. A hole was made in one of the uprights and a deep groove in the other for the portions of the windlass barrel representing the axle to work in; the uprights were kept in position by means of another slab of wood, called a cap, extending from the top of one upright to the other; the solepieces were kept in position by being fastened to cross logs. The next improvement was the introduction of larger and better formed barrels, bound at each end with iron bands, and iron pins or axles driven into the ends of the barrel, an iron handle being fitted by means of an eye and a key to the axle, at one end. After a time two handles were used, one of them being fixed into the barrel, the other being fitted on as before-mentioned. At a later date both handles were fixed. After the introduction of the iron handles copper coins were placed in the holes or grooves for the axles to turn upon, and these were followed by the use of patent brushes, with oil-boxes, which very much reduced the friction—the latest improvement being the addition of a fly-wheel. During the time that the several improvements were being made in the windlass the horse-whip and the whim were introduced. The horse-whip consisted of a set of legs with cross logs at the top, and with a pulley-wheel working on an axle fitted into the cross logs, similar to but on a smaller scale than the poppet-heads at present in use. The rope was passed over the pulley-wheel and made fast at one end to the harness, the other end being lowered down the shaft; the horse was then driven along the road (laid down for that purpose) from the shaft, till the bucket, which had been attached to the other end of the rope, had been raised to the proper height. When the bucket had been emptied the rope was unhooked from the swingle-tree, the horse was turned round, the rope was hooked on to the horse’s collar, and as the horse walked towards the shaft the bucket was lowered down the shaft again. For the purpose of emptying the dirt from the bucket a hook or pair of pincers, attached to a rope made fast to the framework, was inserted into a ring or band at the bottom of the bucket, which was raised nearly to the pulley-wheel for that purpose, and then as the bucket was lowered by backing the horse, the bucket was drawn aside from over the shaft, and as the rope by which the bucket had been drawn up the shaft was slackened, the rope attached to the bottom of the bucket being tight, the bucket was capsized, and the contents shot out into a barrow placed there to receive them; the bucket having been emptied the hook or pincers were removed from the bottom of the bucket, and it was lowered down the shaft again. These whips were sometimes used to work two buckets, one

up and the other down ; but they were very troublesome and expensive, consequently were not generally used. The whim has been in use since 1854, and no material improvement has been made in it, though it was very generally used before the introduction of steam-engines.

RAISING WATER.

The modes of raising water in the early days were similar to the modes of raising washdirt, &c., that is to say in buckets by means of windlass, whip, or whim, except that the Californian pump and Chinese pump were sometimes used to raise water from paddocks. Buckets, or rather bags composed of bullock hides fitted on to iron rings and mounted with iron handles, were much used in baling ; then large size wooden buckets with a valve at the bottom, opening inwards, were introduced for baling, but they did not answer very well, as the gravel was very apt to get into the valve and keep it from shutting, the water would then all run out before the bucket reached the surface ; otherwise they were very convenient, because, when the bucket reached the surface and had been landed, the valve could be opened by pulling a cord, and thus the water could be discharged without capsizing the bucket. The next improvement introduced was the iron tank under the cage, and this is still used except where superseded by the pump worked by steam-power.

MODES OF BRINGING WASHDIRT, ETC., TO THE SHAFT.

The earliest mode of bringing the earth along the drives to the shaft was throwing it by the shovel ; the next was carrying it in buckets (the small American bucket being used for that purpose) ; the next was wheeling it in a barrow along planks laid down in the drive and emptying it on a plat at the mouth of the drive, from which it was shovelled into the bucket ; the next mode was by trucks, which were run along the drives on rails and emptied on to a flat near the shaft, and thence shovelled into the bucket, but when the cage was introduced the trucks were run right into the cage and sent up to the surface. For the purpose of turning trucks from one drive into another drive running in a different direction, the turn-table was first used ; but, more recently, a plain sheet of iron is laid at the junction of drives, and the truck being run on to it can be turned in any direction. At first one truck was pushed along by one or more men, then two or more trucks were pushed along together, then horses were employed underground to draw the trucks along the drives, and a metalled roadway for the horses is now made between the rails.

MODES OF VENTILATING.

The earliest mode of ventilating a shaft was by means of a calico windsail (similar to those used on shipboard for conveying air into the ship's hold) suspended from a pole, the wings being kept open by means of cords fastened to pegs, and the pipe hanging down the shaft ; after a time the pipe was extended and carried along the drive, but the windsail was not sufficient to force air along the drives. The fanner was the next apparatus introduced for the purposes of ventilating the underground works. The fanner was set in motion by means of a cord passed over a wheel attached to the spindle on which the wings of the fanner were fixed, and over another wheel which was turned by a handle. The fanner was afterwards connected with and worked by the windlass, and then later it was worked by steam-power, being connected by means of a belt with the engine. The piping first used was composed of calico, then of tin or galvanized iron. The next plan adopted was dividing the shaft by means of

centre slabs, and dividing the main drive by a wooden partition ; and in order to clear the drives of foul air, a quantity of water was thrown down one compartment of the shaft so as to displace the air and force it through the drive, and up the other compartment of the shaft. The next mode was the carrying of air-drives in the same direction as the main drives at a higher level, and constructing openings at various points from one drive to the other. The next mode was the construction of a furnace underground connected with the air-drives. The next was the building of an air-stack over an air-shaft connected with one of the compartments of the main shaft. The next was the air-duct; and lastly the air-engine in use at the Band of Hope Company's claim, and an apparatus introduced by Mr. John Sharpe, now being tested.

MODES OF WASHING.

The earliest mode of washing was by means of the tin-dish, the clay being disintegrated by stirring or by rubbing between the hands; then the cradle and tin-dish together; then the tub for puddling the dirt before putting it into the cradle, the spade or shovel being used for stirring and breaking up the earth in the puddling-tub. The earth having been puddled was passed through the cradle to get rid of the bulk of the refuse, and then the gold was separated from the residue by means of "panning off" (i.e., washing in the tin-dish). After a time the puddling machine worked by horse-power was introduced. These machines were in the early days constructed of slabs of wood or boards fitted together and built into the ground, and the harrows for puddling the dirt were made of wood; after a time the frame of the harrows only were made of wood, the teeth or spikes being of iron. The earth after having been puddled was passed through a long-tom and washed off in a cradle and tin-dish, or in a tin-dish alone; at a later date the sluice was used instead of the long-tom. After a time the puddling machines were worked by steam instead of horse-power, and the harrows were made entirely of iron; then sheets of iron were laid upon the bottom of the machine inside, to prevent the harrows from tearing the wood; then the machines were lined throughout with sheet iron; then they were made of thick sheet iron riveted together; then they were made of boiler-plate riveted; and now they are made of cast-iron, moulded in segments and fitted together. The buddle was introduced for the purpose of saving the fine gold, that is to say, for extracting from the sludge which had run off from the puddling machine the fine gold which had been carried off with the sludge, and lately the sludge machine has in most cases superseded the buddle.

MODES OF VENTILATING MINES.

The pneumatic engine, patented by Messrs. Bull, Sharpe, and Errington, was first erected by the patentees in the mine of the Ballaarat Tunnel Company, in August, 1866, for the purpose of demonstrating the feasibility of applying compressed air for driving an engine doing ordinary mine work. The engine was placed in the company's adit, 3,000 feet from the mouth, for the purpose of draining the gutter workings, which were about forty feet deeper. The company's works consist of an adit 3,000 feet long, an incline from the end of this 300 feet, reaching down to the gutter workings, and a blind shaft from the upper to the lower levels; also numerous drives in washdirt, rises, air-drives, &c. For the purpose of draining the gutter workings the company employed a four-inch pump, worked by a horse-whim, but it was insufficient. They then used a patent hydraulic pump; but it was found insufficient, and the mine was flooded out, the water rising from the lower to the upper workings, and flowing out of the mouth of the adit, in ninety-six hours. Outside the tunnel

there was a fourteen-inch steam engine used for driving two puddling machines. To an ordinary pump crank, on the first motion of this engine, was fitted the machinery for compressing the air, which was conveyed along 3,000 feet of two-inch iron pipes to another ordinary engine, which had been fixed in the place of the whim. These two-inch pipes acted just in the same manner as the steam pipe from a boiler does to an ordinary steam engine, the only difference being that instead of conveying steam in a state of compression they conveyed atmospheric air in a state of compression. The engine to which this compressed air was conveyed is called by the inventors a pneumatic engine. The compression was accomplished at the engine on the surface by means of an air pump in the form of a cylinder, in which a piston and valves act as in an ordinary air machine. The principle is the same as the common hydraulic press, or any common force pump, but in its mode of working it more nearly resembles the air machine. Two circular valves, about four inches in diameter, admit the air alternately at each end of the cylinder; by the stroke of the piston it is next forced through other two valves into a breeching pipe, the piston working on a three and a-half feet stroke, and at the rate of about twenty-eight strokes per minute. To the top of this breech-pipe was fixed the service-pipe to the pumping engine, 3,000 feet along the drive. To reduce as much as possible the great heat engendered by the compressing process, the air cylinder was kept immersed in a bath supplied with a small stream of running water, notwithstanding which the first hundred or two feet of the pipes were nearly as hot as steam pipes; but by the time it reached the end the air blew off perfectly cold, and kept the mine thoroughly ventilated, where previously the air had been most impure. Before ventilating, the air, after passing a safety valve loaded to about forty pounds to the square inch, passed directly into the valves of the pneumatic engine, eight and a-half inch cylinder, sixteen-inch stroke, which worked an eight-inch double-action pump, throwing up from 100 to 120 gallons of water per minute. The air in passing through the valves makes a noise similar to steam, and when issuing from the escape pipe is icy-cold, the moisture escaping with the compressed air forming into ice about the mouth of the pipe. When the safety valve was entirely lifted the engine stopped, but immediately after the valve was closed the engine began to move again. This engine was started on a Saturday, and by the following Wednesday the mine was pumped out and thoroughly ventilated. Winding gear was then attached to the engine, and it was used for winding as well as pumping. The pneumatic engine has recently been removed to and fitted up in a mine on the Rocky Lead, where it is working very satisfactorily.

The air engine, as used by the Band of Hope Company and the Albion Company, consists of a cast-iron cylinder bored out in the same manner as the cylinder of a steam engine. It is worked with a piston similar to that of a steam engine, having a reciprocating motion imparted by a steam engine usually working direct from the end of the piston of the steam engine, which is passed through the back end of the cylinder through the cylinder cover. At each end of the cylinder two or more valves are placed; these valves are hung by the top end with a leather joint, or metal hinge, in a vertical direction, or nearly so, opening inwards to the cylinder, through which valves the air is drawn by the motion of the piston, and upon the return stroke of the piston these valves close and another set of valves (also placed at each end of the cylinder and hung as aforesaid) open into the conducting pipes and outwards from the cylinder. As soon as the density of the air in the cylinder exceeds that previously pressed into the conducting pipes, the valves are forced open, and the air is forced through the conducting pipes into the mine for the purpose of ventilation.

APPENDIX B.

Tables relating to the Goldfields, &c.



No. 1.

SUMMARY.—TABLE SHOWING THE NUMBER OF MINERS ON THE GOLDFIELDS SINCE 1851.

Year ending 31st December.	Adult Males (including Chinese).	Chinese.	Total Adult Miners.*
1851	19,300	—	—
1852	33,800	—	—
1853	52,800	—	—
1854	65,763	—	—
1855	109,665	19,244	—
1856	115,343	18,109	—
1857	132,508	36,327	—
1858	147,358	33,673	—
1859	139,230	26,044	125,764
1860	144,396	24,886	108,562
1861	—	—	100,463
1862	—	—	93,379
1863	—	—	92,994
1864	—	—	84,986
1865	—	—	79,457
1866	—	—	70,794
1867	—	—	63,053
1868	—	—	64,658

* The information in this column is compiled from the *Mining Surveyors' Reports*; all the other portion of the return is from statements furnished from time to time by the Wardens or other officers in charge of the several districts.

No. 2.

SUMMARY.—NUMBER OF MINERS EMPLOYED IN THE COLONY OF VICTORIA, 1859 TO 1868 INCLUSIVE.

Year ending 31st December.	ALLUVIAL MINERS.		QUARTZ MINERS.		TOTALS.		Grand Totals.
	European.	Chinese.	European.	Chinese.	European.	Chinese.	
1859	85,249	25,149	15,342	24	100,591	25,173	125,764
1860	69,724	20,542	18,268	28	87,992	20,570	108,562
1861	61,516	24,536	14,403	8	75,919	24,544	100,463
1862	53,042	23,634	16,675	28	69,717	23,662	93,379
1863	54,050	23,271	15,661	12	69,711	23,283	92,994
1864	47,234	21,589	16,155	8	63,389	21,597	84,986
1865	41,226	20,905	17,298	28	58,524	20,933	79,457
1866	35,816	20,100	14,844	34	50,660	20,134	70,794
1867	33,407	15,629	13,970	47	47,377	15,676	63,053
1868	35,335	15,244	14,023	56	49,358	15,300	64,658

No. 3.

NUMBER OF MINERS EMPLOYED IN THE MINING DISTRICT OF BALLAARAT, 1859 TO 1868 INCLUSIVE.

Year ending 31st December.	ALLUVIAL MINERS.		QUARTZ MINERS.		TOTALS.		Grand Totals.
	European.	Chinese.	European.	Chinese.	European.	Chinese.	
1859	16,559	4,978	2,561	—	19,120	4,978	24,098
1860	10,370	3,946	4,003	28	14,373	3,974	18,347
1861	9,760	4,539	2,918	8	12,678	4,547	17,225
1862	11,115	4,411	2,540	28	13,655	4,439	18,094
1863	10,865	4,268	2,383	—	13,248	4,268	17,516
1864	10,946	4,034	2,342	8	13,288	4,042	17,330
1865	10,113	3,856	3,195	6	13,308	3,862	17,170
1866	11,167	3,019	1,999	6	13,166	3,025	16,191
1867	10,884	3,053	2,194	8	13,078	3,061	16,139
1868	9,897	3,113	2,701	11	12,598	3,124	15,722

No. 4.

NUMBER OF MINERS EMPLOYED IN THE MINING DISTRICT OF BEECHWORTH, 1859 TO 1868 INCLUSIVE.

Year ending 31st December.	ALLUVIAL MINERS.		QUARTZ MINERS.		TOTALS.		Grand Totals.
	European.	Chinese.	European.	Chinese.	European.	Chinese.	
1859	12,607	5,315	304	—	12,911	5,315	18,226
1860	12,463	5,975	773	—	13,236	5,975	19,211
1861	10,700	4,849	1,085	—	11,785	4,849	16,634
1862	12,510	6,790	1,546	—	14,056	6,790	20,846
1863	11,815	7,200	1,985	—	13,800	7,200	21,000
1864	5,586	6,162	4,117	—	9,703	6,162	15,865
1865	5,067	5,074	4,617	—	9,684	5,074	14,758
1866	5,003	4,770	2,933	8	8,036	4,778	12,814
1867	3,580	3,504	2,624	5	6,204	3,509	9,713
1868	3,769	3,876	1,879	19	5,648	3,895	9,543

NOTE.—Gippeland was separated from Beechworth and erected into a mining district on the 17th December, 1866.

No. 5.

NUMBER OF MINERS EMPLOYED IN THE MINING DISTRICT OF SANDHURST, 1859 TO 1868 INCLUSIVE.

Year ending 31st December.	ALLUVIAL MINERS.		QUARTZ MINERS.		TOTALS.		Grand Totals.
	European.	Chinese.	European.	Chinese.	European.	Chinese.	
1859	9,961	2,037	5,722	—	15,683	2,037	17,720
1860	8,635	1,266	4,459	—	13,094	1,266	14,360
1861	6,596	1,319	3,553	—	10,149	1,319	11,468
1862	6,412	1,520	3,341	—	9,753	1,520	11,273
1863	8,064	1,769	3,297	—	11,361	1,769	13,130
1864	7,160	1,664	3,504	—	10,664	1,664	12,328
1865	5,250	1,427	3,876	—	9,126	1,427	10,553
1866	4,870	1,863	4,118	—	8,988	1,863	10,851
1867	4,781	1,418	3,698	—	8,479	1,418	9,897
1868	9,256	693	3,597	—	12,853	693	13,546

No. 6.

NUMBER OF MINERS EMPLOYED IN THE MINING DISTRICT OF MARYBOROUGH, 1859 TO 1868 INCLUSIVE.

Year ending 31st December.	ALLUVIAL MINERS.		QUARTZ MINERS.		TOTALS.		Grand Totals.
	European.	Chinese.	European.	Chinese.	European.	Chinese.	
1859	27,300	3,750	1,883	—	29,183	3,750	32,933
1860	28,598	3,120	6,087	—	34,685	3,120	37,805
1861	17,000	4,798	4,770	—	21,770	4,798	26,568
1862	11,780	3,745	6,760	—	18,540	3,745	22,285
1863	12,180	3,130	4,774	12	16,954	3,142	20,096
1864	11,537	3,408	3,046	—	14,583	3,408	17,991
1865	8,728	3,592	2,455	2	11,183	3,594	14,777
1866	6,489	3,571	2,292	—	8,781	3,571	12,352
1867	5,464	2,116	1,909	16	7,373	2,132	9,505
1868	5,028	2,142	1,885	8	6,913	2,150	9,063

No. 7.

NUMBER OF MINERS EMPLOYED IN THE MINING DISTRICT OF CASTLEMAINE, 1859 TO 1868 INCLUSIVE.

Year ending 31st December.	ALLUVIAL MINERS.		QUARTZ MINERS.		TOTALS.		Grand Totals.
	European.	Chinese.	European.	Chinese.	European.	Chinese.	
1859	10,115	7,296	2,352	24	12,467	7,320	19,787
1860	6,597	4,859	1,845	—	8,442	4,859	13,301
1861	6,710	7,481	1,547	—	8,257	7,481	15,738
1862	7,500	6,458	1,999	—	9,499	6,458	15,957
1863	7,433	5,344	2,566	—	9,999	5,344	15,343
1864	9,572	4,599	2,486	—	12,058	4,599	16,657
1865	9,455	5,087	2,345	20	11,800	5,107	16,907
1866	5,578	4,869	2,628	20	8,206	4,889	13,095
1867	4,957	3,325	2,020	18	6,977	3,343	10,320
1868	4,342	3,062	2,036	18	6,378	3,080	9,458

No. 8.

NUMBER OF MINERS EMPLOYED IN THE MINING DISTRICT OF ARARAT, 1859 TO 1868 INCLUSIVE.

Year ending 31st December.	ALLUVIAL MINERS.		QUARTZ MINERS.		TOTALS.		Grand Totals.
	European.	Chinese.	European.	Chinese.	European.	Chinese.	
1859	8,707	1,773	2,520	—	11,227	1,773	13,000
1860	3,061	1,376	1,101	—	4,162	1,376	5,538
1861	10,750	1,550	530	—	11,280	1,550	12,830
1862	3,725	710	489	—	4,214	710	4,924
1863	3,693	1,560	656	—	4,349	1,560	5,909
1864	2,433	1,722	660	—	3,093	1,722	4,815
1865	2,613	1,869	810	—	3,423	1,869	5,292
1866	2,609	2,008	874	—	3,483	2,008	5,491
1867	2,070	1,573	782	—	2,852	1,573	4,425
1868	1,585	1,302	1,238	—	2,823	1,302	4,125

No. 9.

NUMBER OF MINERS EMPLOYED IN THE MINING DISTRICT OF GIPPSLAND, 1867 AND 1868.

Year ending 31st December.	ALLUVIAL MINERS.		QUARTZ MINERS.		TOTALS.		Grand Totals.
	European.	Chinese.	European.	Chinese.	European.	Chinese.	
1867	1,671	640	743	—	2,414	640	3,054
1868	1,458	1,056	687	—	2,145	1,056	3,201

NOTE.—Gippsland was separated from Beechworth and erected into a mining district on the 17th December, 1866.

No. 10.

RETURN OF THE PROBABLE MEAN MALE POPULATION OF TWELVE YEARS OLD AND UPWARDS,
FROM INFORMATION FURNISHED BY W. H. ARCHER, ESQ., REGISTRAR-GENERAL.
1851 TO 1868.

Year.	Probable number of Males twelve years old and upwards.	Year.	Probable number of Males twelve years old and upwards.
1851	37,343	1860	251,035
1852	63,497	1861	248,477
1853	101,626	1862	238,507
1854	144,883	1863	230,895
1855	171,631	1864	240,104
1856	181,402	1865	238,488
1857	196,448	1866	241,199
1858	223,604	1867	246,035
1859	240,584	1868	253,617

No. 11.

TABLE SHOWING THE AVERAGE EARNINGS OF THE MINERS FROM 1851 TO 1868 INCLUSIVE.

Year.	Average Earnings per Man per Annum.		
	£	s.	d.
1851 for three months	30	1	7'69
1852 - - - - -	262	11	6'66
1853 - - - - -	202	15	0'81
1854 - - - - -	130	16	4'08
1855 - - - - -	100	7	2'75
1856 - - - - -	103	11	0'40
1857 - - - - -	83	7	9'59
1858 - - - - -	68	12	8'39
1859 - - - - -	72	10	11'27
1860 - - - - -	79	9	3'07
1861 - - - - -	74	15	11
1862 - - - - -	67	14	5'11
1863 - - - - -	70	9	0'42
1864 - - - - -	74	1	9'29
1865 - - - - -	74	4	2'09
1866 - - - - -	80	8	3'87
1867 - - - - -	87	1	6'91
1868 - - - - -	104	18	8'75

NOTE.—From 1851 to 1858 inclusive, the value of the gold obtained is divided amongst the *entire adult male population of the goldfields*; and since 1859 amongst only those *persons actually engaged in mining*—using the mean numbers employed throughout the year.

THE FOLLOWING TABLE SHOWS THE EARNINGS RESPECTIVELY OF ALLUVIAL AND QUARTZ MINERS FOR THE YEARS 1863 TO 1868 INCLUSIVE.

Year.	Average Earnings of Alluvial Miners.	Average Earnings of Quartz Miners.	Average Earnings of Alluvial and Quartz Miners.
	£ s. d.	£ s. d.	£ s. d.
1863	59 7 10'25	123 3 9'50	70 9 0'42
1864	61 6 0	130 13 9'75	74 1 9'29
1865	66 16 3	101 10 5'50	74 4 2'09
1866	66 4 1	132 17 4'75	80 8 3'87
1867	67 10 7'25	158 11 8'75	87 1 6'91
1868	87 6 11'27	165 13 3'42	104 18 8'75

NOTE.—These calculations are based on the value of the gold exported.

No. 12.

SUMMARY.—NUMBER OF MACHINES EMPLOYED IN ALLUVIAL AND QUARTZ MINING RESPECTIVELY IN THE COLONY OF VICTORIA, FROM THE YEAR 1859 TO 1868 INCLUSIVE.

Year.	ALLUVIAL MINING.														
	Steam Engines employed in Winding, Pumping, &c.		Puddling Machines.	Whims.	Whips.	Quicksilver and Compound Cradles.	Sluices, Toms, and Sluice-boxes.	Water-wheels.	Hydraulic Hoses.	Pumps.	Stamp-heads crushing Cement.	Hand Machines.	Derricks.	Crushing Machines.	Boring Machines.
	Total Number.	Aggregate Horse-power.													
1859	285	3,821	3,982	396	113	—	168	101	—	27	—	3	—	—	—
1860	294	4,137½	3,958	354	134	—	623	138	19	37	—	—	—	—	—
1861	331	4,731	4,016	468	138	—	165	124	18	113	—	—	—	—	—
1862	347	5,528	4,176	527	241	—	3,920	360	24	289	—	—	2	—	—
1863	357	5,999	4,269	447	172	—	4,882	404	14	114	—	—	6	9	—
1864	441	6,891	4,031	445	95	—	5,225	257	30	167	409	—	5	6	—
1865	473	8,208	3,228	427	115	—	5,076	196	33	180	461	—	8	25	4
1866	480	9,981	2,559	412	99	40	6,202	153	10	170	571	—	8	—	6
1867	470	9,863	2,293	332	168	214	19,592	207	8	622	659	—	—	—	17
1868	441	9,844	1,887	298	320	261	19,346	339	12	872	643	—	—	—	18

Year.	QUARTZ MINING.											Approximate Value of all Mining Plant in the Colony.	
	Steam Engines employed in Winding, Crushing, &c.		Crushing Machines, driven by other power than Steam.	Stamp-heads.	Whims.	Windmill.	Water-wheels.	Puddling Machine.	Derricks.	Quicksilver Cradles.	Whips.		Pumps.
	Total Number.	Aggregate Horse-power.											
1859	296	4,357½	8	—	69	1	7	—	—	—	4	—	£ 1,155,923
1860	417	6,645	41	—	161	—	5	—	—	—	26	1	1,299,303
1861	453	7,459	54	—	214	—	26	—	5	—	23	7	1,411,012
1862	461	8,055	82	—	191	—	23	—	3	—	49	—	1,492,861
1863	435	7,907	51	—	267	—	29	—	5	—	56	—	1,503,459
1864	447	7,746	105	4,575	203	—	43	1	6	—	66	—	1,496,699
1865	491	8,606	99	5,119	231	—	56	—	15	10	98	—	1,773,271
1866	510	9,231	35	5,437	237	—	65	—	11	—	55	—	2,068,527
1867	532	9,955	57	5,529	463	—	76	—	—	—	371	—	2,079,195
1868	602	11,045	66	5,997	512	—	4	—	—	—	436	—	2,150,432

NOTE.—The Returns of the Number of Machines employed on the Goldfields from 1855 to 1858 inclusive were compiled without any distinction being drawn between Machinery used in Alluvial Mining and in Quartz Mining respectively, and without giving the figures for each Mining District separately. The Tables are as follows:—

Year.	Steam Engines.	Puddling Machines.	Quartz Crushing Machines.	Toms and Sluices.	Horse Machines.	Water-wheels.	Boring Machines.	Whips and Whims.
1855	44	1,521	83	260	—	149	—	—
1856	140	3,526	159	547	30	165	—	370
1857	249	3,657	122	845	—	219	13	459
1858	330	5,241	149	727	72	189	5	283

No. 13.

NUMBER OF MACHINES EMPLOYED IN ALLUVIAL AND QUARTZ MINING RESPECTIVELY IN THE MINING DISTRICT OF BALLAARAT, FROM THE YEAR 1859 TO 1868 INCLUSIVE.

ALLUVIAL MINING.													
Year.	Steam Engines employed in Winding, Pumping, &c.		Puddling Machines.	Whims.	Whips.	Quicksilver and Compound Cradles.	Sluices, Toms, and Sluice-boxes.	Pumps.	Stamp-heads crushing Cement.	Water-wheels.	Derricks.	Crushing Machine.	Boring Machines.
	Total Number.	Aggregate Horse-power.											
1859	222	2,933	794	252	—	—	—	—	—	—	—	—	—
1860	214	3,100½	595	210	—	—	—	—	—	10	—	—	—
1861	219	3,303	569	219	—	—	—	—	—	—	—	—	—
1862	226	4,075	549	203	1	—	—	—	—	—	—	—	—
1863	208	4,091	524	166	15	—	4	—	—	1	—	—	—
1864	254	4,440	608	142	3	—	2	—	52	4	—	—	—
1865	267	4,925	550	92	14	—	50	—	73	8	3	1	4
1866	283	6,804	497	81	10	—	92	—	50	4	3	—	5
1867	280	6,774	579	105	14	11	2,762	32	58	—	—	—	11
1868	256	6,656	286	94	16	10	2,140	43	49	—	—	—	11

QUARTZ MINING.										Approximate Value of all Mining Plant in the District.
Year.	Steam Engines employed in Winding, Crushing, &c.		Crushing Machines, driven by other power than Steam.	Stamp-heads.	Whims.	Water-wheels.	Derricks.	Whips.		
	Total Number.	Aggregate Horse-power.								
1859	55	874	—	—	—	—	—	—	£ 407,026	
1860	113	1,811	—	—	34	—	—	—	454,527	
1861	123	2,251	—	—	35	9	—	10	505,550	
1862	118	2,229	—	—	24	9	—	13	523,600	
1863	120	2,275	—	—	26	8	—	13	497,950	
1864	112	2,243	10	961	22	10	—	9	504,680	
1865	117	2,370	11	1,090	18	11	15	2	573,350	
1866	112	2,149	—	1,009	18	11	—	2	743,683	
1867	102	2,407	5	995	30	12	—	10	713,775	
1868	113	2,559	12	1,071	35	—	—	6	706,393	

No. 14.

NUMBER OF MACHINES EMPLOYED IN ALLUVIAL AND QUARTZ MINING RESPECTIVELY IN THE MINING DISTRICT OF BEECHWORTH, FROM THE YEAR 1859 TO 1868 INCLUSIVE.

Year.	ALLUVIAL MINING.											
	Steam Engines employed in Winding, Pumping, &c.		Puddling Machines.	Whims.	Whips.	Quicksilver and Compound Cradles.	Sluices, Toms, and Sluice-boxes.	Water-wheels.	Hydraulic Hoses.	Pumps.	Derrick.	Boring Machines.
	Total Number.	Aggregate Horse- power.										
1859	24	251	82	22	113	—	168	101	—	—	—	—
1860	34	362	167	41	104	—	290	128	19	—	—	—
1861	41	458	65	68	114	—	—	124	18	100	—	—
1862	50	552	210	73	142	—	3,736	340	24	100	—	—
1863	48	538	229	73	100	—	4,480	395	14	—	1	—
1864	50	563	109	55	45	—	4,540	238	28	88	—	—
1865	51	676	82	55	35	—	4,410	180	32	98	—	—
1866	44	565	80	51	25	—	5,794	143	9	97	—	1
1867	41	519	77	24	43	2	13,634	169	4	267	—	1
1868	44	600	71	24	45	1	13,818	248	10	160	—	4

Year.	QUARTZ MINING.								Approximate Value of all Mining Plant in the District.
	Steam Engines employed in Winding, Crushing, &c.		Crushing Machines, driven by other power than Steam.	Stamp-heads.	Whims.	Water-wheels.	Puddling Machine.	Whips.	
	Total Number.	Aggregate Horse- power.							
1859	6	69	—	—	—	1	—	—	£ 74,220
1860	12	164	—	—	—	5	—	—	118,720
1861	17	222	1	—	1	11	—	3	134,200
1862	13	165	4	—	3	14	—	2	140,702
1863	20	259	—	—	2	21	—	1	188,520
1864	25	328	36	563	—	33	1	—	183,220
1865	33	498	39	733	—	35	—	—	260,631
1866	58	1,046	27	1,145	—	52	—	—	369,100
1867	45	603	1	875	7	45	—	6	246,607
1868	59	802	38	1,006	15	1	—	11	283,445

NOTE.—Gippeland was separated from Beechworth and erected into a mining district on the 17th December, 1866.

No. 15.

NUMBER OF MACHINES EMPLOYED IN ALLUVIAL AND QUARTZ MINING RESPECTIVELY IN THE MINING DISTRICT OF SANDHURST, FROM THE YEAR 1859 TO 1868 INCLUSIVE.

ALLUVIAL MINING.								
Year.	Steam Engines employed in Winding, Pumping, &c.		Puddling Machines.	Whims.	Whips.	Sluices, Toms, and Sluice-boxes.	Water-wheels.	Stamp-heads crushing Cement.
	Total Number.	Aggregate Horse-power.						
1859	13	234	1,262	22	—	—	—	—
1860	18	313	1,592	16	—	1	—	—
1861	5	88	1,466	16	—	—	—	—
1862	5	91	1,355	—	—	9	—	—
1863	4	51	1,424	—	—	—	—	—
1864	31	341	1,209	6	15	80	1	281
1865	27	363	803	1	—	84	1	242
1866	32	399	601	2	—	—	—	265
1867	33	486	489	20	72	185	—	298
1868	33	494	433	16	124	141	—	298

QUARTZ MINING.								Approximate Value of all Mining Plant in the District.
Year.	Steam Engines employed in Winding, Crushing, &c.		Crushing Machines, driven by other power than Steam.	Stamp-heads.	Whims.	Water-wheels.	Whips.	
	Total Number.	Aggregate Horse-power.						
1859	99	1,505	—	—	38	—	4	\$ 282,623
1860	126	2,060	—	—	66	—	16	296,735
1861	140	2,056	21	—	19	—	—	271,000
1862	129	2,137	24	—	5	—	—	286,000
1863	106	2,054	2	—	39	—	4	254,555
1864	100	1,616	6	959	11	—	4	252,215
1865	129	2,288	4	1,220	16	—	25	362,715
1866	138	2,510	—	1,333	28	—	6	397,450
1867	137	2,686	7	1,320	177	1	233	421,150
1868	142	2,727	4	1,378	184	1	241	418,738

No. 16.

NUMBER OF MACHINES EMPLOYED IN ALLUVIAL AND QUARTZ MINING RESPECTIVELY IN THE MINING DISTRICT OF MARYBOROUGH, FROM THE YEAR 1859 TO 1868 INCLUSIVE.

Year.	ALLUVIAL MINING.												
	Steam Engines employed in Winding, Pumping, &c.		Puddling Machines.	Whims.	Whips.	Quicksilver and Compound Cradles.	Sluices, Toms, and Sluice-boxes.	Hydraulic Hoses.	Pumps.	Crushing Machine.	Stamp-heads crushing Cement.	Water-wheels.	Poring Machines.
	Total Number.	Aggregate Horse-power.											
1859	10	140	707	55	—	—	—	—	—	—	—	—	—
1860	12	184	649	43	—	—	—	—	—	—	—	—	—
1861	21	284	803	56	—	—	34	—	—	—	—	—	—
1862	21	289	968	74	3	—	32	—	—	—	—	—	—
1863	23	323	1,008	120	6	—	35	—	—	—	—	—	—
1864	39	664	1,103	167	—	—	57	2	—	—	14	—	—
1865	45	715	851	180	10	—	34	1	4	1	—	—	—
1866	48	793	692	201	8	32	—	1	—	—	—	—	—
1867	38	703	524	105	9	66	180	2	9	—	18	—	2
1868	44	835	496	104	24	102	184	2	342	—	22	2	—

Year.	QUARTZ MINING.							Approximate Value of all Mining Plant in the District.
	Steam Engines employed in Winding, Crushing, &c.		Crushing Machines, driven by other power than Steam.	Stamp-heads.	Whims.	Windmill.	Whips.	
	Total Number.	Aggregate Horse-power.						
1859	40	590½	—	—	—	1	—	£ 115,315
1860	59	901	2	—	22	—	—	133,870
1861	67	1,074	3	—	79	—	—	168,916
1862	78	1,363	7	—	76	—	16	198,096
1863	77	1,472	8	—	103	—	24	191,866
1864	78	1,212	9	715	64	—	25	192,450
1865	75	1,073	7	639	46	—	53	182,500
1866	70	1,151	6	721	40	—	29	196,050
1867	82	1,422	9	656	68	—	37	211,500
1868	95	1,670	—	682	100	—	71	227,348

No. 17.

NUMBER OF MACHINES EMPLOYED IN ALLUVIAL AND QUARTZ MINING RESPECTIVELY IN THE MINING DISTRICT OF CASTLEMAINE, FROM THE YEAR 1859 TO 1868 INCLUSIVE.

Year.	ALLUVIAL MINING.													
	Steam Engines employed in Winding, Pumping, &c.		Fuddling Machines.	Whims.	Whips.	Quicksilver and Compound Cradles.	Sluices, Toms, and Sluice-boxes.	Water-wheels.	Pumps.	Stamp-heads crushing Cement.	Hand Machines.	Derricks.	Crushing Machines.	Boring Machines.
	Total Number.	Aggregate Horse-power.												
1859	8	118	867	31	—	—	—	—	27	—	3	—	—	—
1860	8	76	864	17	30	—	332	—	37	—	—	—	—	—
1861	19	294	939	21	24	—	68	—	13	—	—	—	—	—
1862	16	226	893	6	32	—	14	20	97	—	—	2	—	—
1863	37	547	933	43	43	—	138	8	112	—	—	5	—	—
1864	38	585	855	53	26	—	132	14	75	50	—	5	1	—
1865	60	1,263	798	79	49	—	190	7	78	134	—	5	3	—
1866	48	1,017	610	63	48	—	122	6	73	178	—	5	—	—
1867	53	977	519	64	23	107	497	8	95	188	—	—	—	1
1868	43	846	521	48	75	122	637	14	146	166	—	—	—	1

Year.	QUARTZ MINING.									Approximate Value of all Mining Plant in the District.
	Steam Engines employed in Winding, Crushing, &c.		Crushing Machines, driven by other power than Steam.	Stamp-heads.	Whims.	Pumps.	Water-wheels.	Derricks.	Whips.	
	Total Number.	Aggregate Horse-power.								
1859	85	1,103	8	—	31	—	6	—	—	£ 230,789
1860	90	1,409	39	—	24	1	—	—	10	250,951
1861	93	1,569	29	—	49	7	6	5	10	263,446
1862	100	1,664	31	—	56	—	—	3	14	256,448
1863	94	1,433	30	—	72	—	—	5	8	268,108
1864	112	1,906	35	1,125	80	—	—	6	20	277,334
1865	116	1,889	29	1,127	125	—	10	—	15	304,145
1866	109	1,857	2	983	131	—	2	11	18	265,584
1867	107	1,839	26	919	146	—	5	—	81	254,805
1868	128	1,982	3	1,050	140	—	1	—	97	277,248

No. 18.

NUMBER OF MACHINES EMPLOYED IN ALLUVIAL AND QUARTZ MINING RESPECTIVELY IN THE MINING DISTRICT OF ARARAT, FROM THE YEAR 1859 TO 1868 INCLUSIVE.

Year.	ALLUVIAL MINING.										
	Steam Engines employed in Winding, Pumping, &c		Puddling Machines.	Whims.	Whips.	Quicksilver and Compound Cradles.	Sluices, Toms, and Sluice-boxes.	Crushing Machines.	Pumps.	Stamp-heads crushing Cement.	Boring Machines.
	Total Number.	Aggregate Horse- power.									
1859	8	145	270	14	—	—	—	—	—	—	—
1860	8	102	91	27	—	—	—	—	—	—	—
1861	26	304	174	88	—	—	63	—	—	—	—
1862	29	295	201	171	63	—	129	—	92	—	—
1863	37	449	151	45	8	—	225	9	2	—	—
1864	29	298	147	22	6	—	414	5	4	12	—
1865	23	266	144	20	7	—	308	20	—	12	—
1866	25	403	79	14	8	8	194	—	—	78	—
1867	25	404	80	14	7	28	189	—	2	97	2
1868	21	413	75	12	36	26	182	—	—	108	2

Year.	QUARTZ MINING.							Approximate Value of all Mining Plant in the District.
	Steam Engines employed in Winding, Crushing, &c.		Crushing Machines, driven by other power than Steam.	Stamp-heads.	Whims.	Whips.	Quicksilver Cradles.	
	Total Number.	Aggregate Horse- power.						
1859	11	216	—	—	—	—	—	£
1860	17	300	—	—	15	—	—	45,950
1861	13	287	—	—	31	—	—	44,500
1862	23	497	16	—	27	4	—	67,900
1863	18	414	11	—	25	6	—	88,015
1864	20	441	9	252	26	8	—	102,460
1865	21	488	9	310	26	3	10	86,800
1866	23	518	—	246	20	—	—	89,930
1867	27	579	8	306	34	3	—	96,660
1868	28	712	—	376	37	10	—	110,558
								117,451

No. 19.

NUMBER OF MACHINES EMPLOYED IN ALLUVIAL AND QUARTZ MINING RESPECTIVELY IN THE MINING DISTRICT OF GIPPSLAND, IN 1867 AND 1868.

	ALLUVIAL MINING.						
Year.	Steam Engines employed in Winding, Pumping, &c.		Puddling Machines.	Sluices, Toms, and Sluice-boxes.	Water- wheels.	Hydraulic Hoses.	Pumps.
	Number.	Aggregate Horse-power.					
1867	—	—	25	2,145	30	2	217
1868	—	—	5	2,244	75	—	181

	QUARTZ MINING.							Approximate Value of all Mining Plant in the District.
Year.	Steam Engines employed in Winding, Crushing, &c.		Crushing Machines, driven by other power than Steam.	Stamp- heads.	Whims.	Water- wheels.	Whip.	
	Number.	Aggregate Horse-power.						
1867	32	419	1	458	1	13	1	£ 120,800
1868	37	593	9	434	1	1	—	119,809

NOTE.—Gippsland was separated from Beechworth and erected into a mining district on the 17th December, 1866.

No. 20.

TABLE SHOWING THE AREA OF LAND HELD AS CLAIMS UNDER THE DISTRICT BYE-LAWS, AND THE PROPORTION OF THE SAME PROTECTED BY REGISTRATION OR BY EXEMPTION CERTIFICATES, IN THE SEVERAL MINING DISTRICTS, ON THE 31ST DECEMBER, 1865, 1866, 1867, AND 1868 RESPECTIVELY.

Mining Districts.	1865.						1866.					
	Total Area of Land held as Claims under the Bye-laws.			Aggregate Area of Land so held and not worked, being protected by Certificates.			Total Area of Land held as Claims under the Bye-laws.			Aggregate Area of Land so held and not worked, being protected by Certificates.		
	A.	R.	P.	A.	R.	P.	A.	R.	P.	A.	R.	P.
Ballaarat - - -	32,747	0	0	6,636	2	34	22,643	0	25	4,237	3	27
Beechworth - - -	37,719	1	36	11,244	0	0	27,482	1	2	4,561	2	27
Sandhurst - - -	4,041	0	0	938	1	0	3,190	1	10	561	2	26
Maryborough - - -	1,833	2	5	204	2	29	1,891	3	26	227	1	39
Castlemaine - - -	31,172	1	34	16,587	1	32	9,265	1	29	1,807	3	9
Ararat - - -	11,243	3	12	4,120	2	0	12,073	1	14	9,391	3	6
Totals - - -	118,757	1	7	39,731	2	15	76,546	1	26	20,788	1	14

Mining Districts.	1867.						1868.					
	Total Area of Land held as Claims under the Bye-laws.			Aggregate Area of Land so held and not worked, being protected by Certificates.			Total Area of Land held as Claims under the Bye-laws.			Aggregate Area of Land so held and not worked, being protected by Certificates.		
	A.	R.	P.	A.	R.	P.	A.	R.	P.	A.	R.	P.
Ballaarat - - -	20,877	1	25	3,210	0	14	30,633	0	22	5,349	3	28
Beechworth - - -	25,834	1	7	8,350	2	5	43,052	2	0	25,148	2	0
Sandhurst - - -	4,129	0	0	293	0	3	4,488	2	30	555	3	24
Maryborough - - -	4,672	2	19	261	3	0	3,314	1	5	265	0	17
Castlemaine - - -	6,066	1	29	366	0	23	5,400	2	0	668	3	24
Ararat - - -	7,038	0	0	270	0	0	5,694	3	29	230	2	6
Gippsland - - -	7,060	0	36	854	2	0	8,357	3	9	422	3	39
Totals - - -	75,677	3	36	13,606	0	5	100,941	3	15	32,641	3	18

NOTE.—The areas given in the second column are included in the first.

No. 21.

TABLE SHOWING THE AREA OF LAND HELD AS CLAIMS UNDER THE DISTRICT BYE-LAWS, AND THE PROPORTION OF THE SAME NOT BEING WORKED, BEING PROTECTED BY REGISTRATION OR BY EXEMPTION CERTIFICATES, IN THE SEVERAL DIVISIONS AND SUBDIVISIONS, ON THE 31ST DECEMBER, 1868.

Mining Districts, Divisions, and Subdivisions.	Total Area of Land held as Claims under the Bye-Laws.			Aggregate Area of Land so held and not worked, being protected by Certificates.		
	A.	R.	P.	A.	R.	P.
BALLAARAT—						
Central Division - - - - -	11,100	0	0	2,530	2	0
Southern Division - - - - -	1,622	2	26	356	2	15
Buninyong Division - - - - -	3,025	0	1	625	2	28
Smythesdale Division - - - - -	5,804	1	6	299	2	5
Creswick Division - - - - -	3,681	0	0	1,118	3	0
Gordon Subdivision - - - - -	2,530	0	0	259	0	0
Steiglitz Subdivision - - - - -	1,970	3	22	90	1	26
Blackwood Division - - - - -	820	2	20	69	1	34
Blue Mountain South Subdivision - - - - -	78	2	27	—		
Totals - - - - -	30,633	0	22	5,349	3	28
BEECHWORTH—						
Beechworth Subdivision - - - - -	17,820	0	0	11,525	0	0
Stanley Subdivision - - - - -	482	0	0	44	0	0
Yackandandah Subdivision - - - - -	2,000	0	0	50	0	0
Sandy Creek Subdivision - - - - -	129	2	0	—		
Indigo Division - - - - -	18,800	0	0	13,190	0	0
Buckland Division - - - - -	1,323	0	0	219	0	0
Jamieson North Subdivision - - - - -	1,050	0	0	50	0	0
Gaffney's Creek Subdivision - - - - -	280	0	0	12	0	0
Wood's Point Subdivision - - - - -	230	0	0	9	2	0
Big River Subdivision - - - - -	273	0	0	5	0	0
Mitta-Mitta Division - - - - -	400	0	0	40	0	0
Jamieson South Subdivision - - - - -	265	0	0	4	0	0
Totals - - - - -	43,052	2	0	25,148	2	0
SANDHURST—						
Sandhurst Division - - - - -	2,911	2	30	211	3	24
Kilmore Division - - - - -	500	0	0	130	0	0
Heathcote Division and Waranga South Subdivision - - - - -	612	0	0	70	0	0
Waranga North Subdivision - - - - -	345	0	0	120	0	0
Raywood Division - - - - -	120	0	0	24	0	0
Totals - - - - -	4,488	2	30	555	3	24
MARYBOROUGH—						
Maryborough Division - - - - -	1,227	2	5	51	1	38
Amherst Division - - - - -	480	0	0	36	0	0
Avoca Subdivision - - - - -	160	0	0	—		
Dunolly and Tarnagulla Divisions - - - - -	640	0	0	63	0	19
Korong Division - - - - -	577	0	0	69	0	0
Redbank and St. Arnaud South Subdivisions - - - - -	135	0	0	12	0	0
St. Arnaud North Subdivision - - - - -	94	3	0	33	2	0
Totals - - - - -	3,314	1	5	265	0	17

No. 21.—TABLE SHOWING THE AREA OF LAND HELD AS CLAIMS, ETC.—*continued.*

Mining Districts, Divisions, and Subdivisions.	Total Area of Land held as Claims under the Bye-Laws.			Aggregate Area of Land so held and not worked, being protected by Certificates.		
	A.	R.	P.	A.	R.	P.
CASTLEMAINE—						
Castlemaine Division - - - - -	1,263	2	0	123	0	24
Fryer's Creek Subdivision - - - - -	1,440	0	0	93	0	0
Hepburn Division - - - - -	2,100	0	0	269	3	32
Taradale Subdivision - - - - -	41	3	0	17	3	0
Maldon Division - - - - -	279	3	20	73	3	28
St. Andrew's Division - - - - -	165	3	18	37	1	20
Kyneton Subdivision - - - - -	14	3	2	1	3	0
Blue Mountain North Subdivision - - - - -	94	3	0	52	0	0
Totals - - - - -	5,400	2	0	668	3	24
ARARAT—						
Ararat Division - - - - -	5,122	3	29	30	2	6
Pleasant Creek Division - - - - -	205	0	0	120	0	0
Barkly Division - - - - -	180	0	0	—	—	—
Raglan Division - - - - -	187	0	0	80	0	0
Totals - - - - -	5,694	3	29	230	2	6
GIPPSLAND—						
Omeo Subdivision - - - - -	549	2	20	159	2	10
Mitchell River Subdivision - - - - -	500	0	0	60	0	0
Crooked River Subdivision - - - - -	1,250	0	0	56	0	0
Jericho Subdivision - - - - -	240	0	0	5	0	0
Donnelly's Creek Subdivision - - - - -	89	3	4	12	1	21
Stringer's Creek Subdivision - - - - -	917	3	5	—	—	—
Russell's Creek Subdivision - - - - -	4,310	2	20	30	0	8
South Tarraville Subdivision - - - - -	Nil	—	—	Nil	—	—
Bendoc Subdivision - - - - -	500	0	0	100	0	0
Totals - - - - -	8,357	3	9	422	3	39

No. 22.

TABLE SHOWING THE ESTIMATED VALUE OF THE CLAIMS IN THE SEVERAL MINING DISTRICTS ON THE 31ST DECEMBER, 1865, 1866, 1867, AND 1868 RESPECTIVELY.

Mining Districts.	1865.	1866.	1867.	1868.
	£	£	£	£
Ballaarat - - - - -	2,392,751	3,142,498	1,803,190	2,158,900
Beechworth - - - - -	1,875,267	2,084,975	1,784,360	1,850,940
Sandhurst - - - - -	2,016,806	1,873,000	1,507,100	2,157,945
Maryborough - - - - -	632,604	558,540	878,118	1,066,494
Castlemaine - - - - -	1,333,146	942,155	756,076	802,995
Ararat - - - - -	248,350	385,899	451,738	579,400
Gippsland - - - - -	—	—	280,630	252,830
Totals - - - - -	8,498,924	8,987,067	7,461,212	8,869,504

No. 23.

TABLE SHOWING THE ESTIMATED VALUE OF THE MINING CLAIMS IN THE SEVERAL DIVISIONS AND SUBDIVISIONS OF EACH MINING DISTRICT ON THE 31ST DECEMBER, 1868.

Mining Districts, Divisions, and Subdivisions.											Value of Claims.
BALLAARAT—											£
Central Division	-	-	-	-	-	-	-	-	-	-	716,150
Southern Division	-	-	-	-	-	-	-	-	-	-	76,200
Buninyong Division	-	-	-	-	-	-	-	-	-	-	200,000
Smythesdale Division	-	-	-	-	-	-	-	-	-	-	80,000
Creswick Division	-	-	-	-	-	-	-	-	-	-	700,000
Gordon Subdivision	-	-	-	-	-	-	-	-	-	-	278,650
Steiglitz Subdivision	-	-	-	-	-	-	-	-	-	-	62,900
Blackwood Division	-	-	-	-	-	-	-	-	-	-	45,000
Blue Mountain South Subdivision	-	-	-	-	-	-	-	-	-	-	—
Totals	-	-	-	-	-	-	-	-	-	-	2,158,900
BEECHWORTH—											
Beechworth Subdivision	-	-	-	-	-	-	-	-	-	-	515,000
Stanley Subdivision	-	-	-	-	-	-	-	-	-	-	10,440
Yackandandah Subdivision	-	-	-	-	-	-	-	-	-	-	600,000
Sandy Creek Subdivision	-	-	-	-	-	-	-	-	-	-	2,600
Indigo Division	-	-	-	-	-	-	-	-	-	-	55,000
Buckland Division	-	-	-	-	-	-	-	-	-	-	243,700
Jamieson North Subdivision	-	-	-	-	-	-	-	-	-	-	230,000
Gaffney's Creek Subdivision	-	-	-	-	-	-	-	-	-	-	60,000
Wood's Point Subdivision	-	-	-	-	-	-	-	-	-	-	74,000
Big River Subdivision	-	-	-	-	-	-	-	-	-	-	14,000
Mitta-Mitta Division	-	-	-	-	-	-	-	-	-	-	11,700
Jamieson South Subdivision	-	-	-	-	-	-	-	-	-	-	34,500
Totals	-	-	-	-	-	-	-	-	-	-	£1,850,940
SANDHURST—											
Sandhurst Division	-	-	-	-	-	-	-	-	-	-	1,963,445
Kilmore Division	-	-	-	-	-	-	-	-	-	-	20,000
Heathcote Division and Waranga South Subdivision	-	-	-	-	-	-	-	-	-	-	100,000
Waranga North Subdivision	-	-	-	-	-	-	-	-	-	-	18,500
Raywood Division	-	-	-	-	-	-	-	-	-	-	56,000
Totals	-	-	-	-	-	-	-	-	-	-	£2,157,945
MARYBOROUGH—											
Maryborough Division	-	-	-	-	-	-	-	-	-	-	117,250
Amherst Division	-	-	-	-	-	-	-	-	-	-	41,574
Avoca Subdivision	-	-	-	-	-	-	-	-	-	-	250,000
Dunolly and Tarnagulla Divisions	-	-	-	-	-	-	-	-	-	-	320,000
Korong Division	-	-	-	-	-	-	-	-	-	-	250,000
Redbank and St. Arnaud South Subdivisions	-	-	-	-	-	-	-	-	-	-	30,000
St. Arnaud North Subdivision	-	-	-	-	-	-	-	-	-	-	57,670
Totals	-	-	-	-	-	-	-	-	-	-	£1,066,494

No. 23.—TABLE SHOWING THE ESTIMATED VALUE OF THE MINING CLAIMS, ETC.—continued.

Mining Districts, Divisions, and Subdivisions.										Value of Claims.
CASTLEMAINE—										£
Castlemaine Division	-	-	-	-	-	-	-	-	-	75,600
Fryer's Creek Subdivision	-	-	-	-	-	-	-	-	-	95,300
Hepburn Division	-	-	-	-	-	-	-	-	-	150,000
Taradale Subdivision	-	-	-	-	-	-	-	-	-	73,265
Maldon Division	-	-	-	-	-	-	-	-	-	328,980
St. Andrew's Division	-	-	-	-	-	-	-	-	-	18,900
Kyneton Subdivision	-	-	-	-	-	-	-	-	-	40,950
Blue Mountain North Subdivision	-	-	-	-	-	-	-	-	-	20,000
Totals	-	-	-	-	-	-	-	-	-	£802,995
ARARAT—										
Ararat Division	-	-	-	-	-	-	-	-	-	31,000
Pleasant Creek Division	-	-	-	-	-	-	-	-	-	520,700
Raglan Division	-	-	-	-	-	-	-	-	-	8,700
Barkly Division	-	-	-	-	-	-	-	-	-	19,000
Totals	-	-	-	-	-	-	-	-	-	£579,400
GIPPSLAND—										
Omeo Subdivision	-	-	-	-	-	-	-	-	-	7,100
Mitchell River Subdivision	-	-	-	-	-	-	-	-	-	45,000
Crooked River Subdivision	-	-	-	-	-	-	-	-	-	25,000
Jericho Subdivision	-	-	-	-	-	-	-	-	-	14,100
Donnelly's Creek Subdivision	-	-	-	-	-	-	-	-	-	6,130
Stringer's Creek Subdivision	-	-	-	-	-	-	-	-	-	120,000
Russell's Creek Subdivision	-	-	-	-	-	-	-	-	-	23,500
South Tarraville Subdivision	-	-	-	-	-	-	-	-	-	—
Bendoc Subdivision	-	-	-	-	-	-	-	-	-	12,000
Totals	-	-	-	-	-	-	-	-	-	£252,830

No. 24.

MINING COMPANIES REGISTERED IN THE SEVERAL COURTS OF MINES TO 31ST DECEMBER, 1868.

Mining Districts.					Number of Companies.	Number of Shares.	Nominal Capital.	
							£	s. d.
Ballaarat	-	-	-	-	908	1,347,924	10,579,711	0 0
Beechworth	-	-	-	-	641	1,240,731	5,935,419	0 0
Sandhurst	-	-	-	-	188	3,057,433	3,100,350	10 0
Maryborough	-	-	-	-	195	873,048½	1,805,410	0 0
Castlemaine	-	-	-	-	431	771,524	2,270,176	0 0
Ararat	-	-	-	-	94	105,667	662,429	0 0
Gippsland	-	-	-	-	14	25,165	77,710	0 0
Totals	-	-	-	-	2,471	7,421,492½	£24,431,205	10 0

NOTE.—It appears from the returns forwarded by the clerks of the courts of mines, that of these companies 188 had been wound up, with 299,070 shares, and a nominal capital of £1,413,302.

No. 25.

NUMBER OF DISTINCT QUARTZ REEFS ACTUALLY PROVED TO BE AURIFEROUS, AND THE TOTAL EXTENT IN SQUARE MILES OF AURIFEROUS ALLUVIAL AND QUARTZ GROUND ACTUALLY WORKED UPON IN THE SEVERAL MINING DISTRICTS.

Mining Districts.	Number of distinct Quartz Reefs proved to be Auriferous.	Extent in Square Miles of Auriferous Alluvial and Quartz Ground worked upon.
Ballaarat - - - - -	175	76½
Beechworth - - - - -	561	166
Sandhurst - - - - -	575	189½
Maryborough - - - - -	475	63½
Castlemaine - - - - -	378	172½
Ararat - - - - -	62	65
Gippsland - - - - -	425	150½
Totals - - - - -	2,651	884

NOTE.—The number of "distinct" quartz reefs cannot be strictly correct, as parts of the same reef, in some localities, are held to be distinct reefs, and named accordingly. As the reefs are further explored it is found, too, that what were supposed to be separate reefs are not really distinct. The extent of auriferous ground is here put down from estimates made by the mining surveyors and registrars—not from actual surveys—and in a few instances the estimates of the present surveyors and registrars differ from those made by their predecessors. The figures vary from year to year; as the shallow alluviums of the older goldfields are abandoned by the miners, they are taken up and occupied, under the provisions of the *Amending Land Act*, by agriculturists and gardeners, and ground which one year was included in the estimated area of gold-workings is excluded in another.

No. 26.

TABLE SHOWING THE NUMBER OF DISTINCT QUARTZ REEFS ACTUALLY PROVED TO BE AURIFEROUS, AND THE TOTAL EXTENT IN SQUARE MILES OF AURIFEROUS ALLUVIAL AND QUARTZ GROUND ACTUALLY WORKED UPON IN THE SEVERAL DIVISIONS AND SUBDIVISIONS OF EACH MINING DISTRICT.

Mining Districts, Divisions, and Subdivisions.	Number of distinct Quartz Reefs proved to be Auriferous.	Extent in Square Miles of Auriferous Alluvial and Quartz Ground worked upon.
BALLAARAT—		
Central Division - - - - -	24	7
Southern Division - - - - -	14	6
Buninyong Division - - - - -	13	14
Smythesdale Division - - - - -	12	11
Creswick Division - - - - -	15	8½
Gordon Subdivision - - - - -	17	3½
Steiglitz Subdivision - - - - -	60	20
Blackwood Division - - - - -	16	2½
Blue Mountain South Subdivision - - - - -	4	4
Totals - - - - -	175	76½
BEECHWORTH—		
Beechworth Subdivision - - - - -	60	35
Stanley Subdivision - - - - -	25	12½
Yackandandah Subdivision - - - - -	63	9
Sandy Creek Subdivision - - - - -	—	2
Indigo Division - - - - -	22	2½
Buckland Division - - - - -	232	60
Jamieson North Subdivision - - - - -	28	13
Gaffney's Creek Subdivision - - - - -	13	3
Wood's Point Subdivision - - - - -	92	18

No. 26.—TABLE SHOWING THE NUMBER OF DISTINCT QUARTZ REEFS, ETC.—*continued.*

Mining Districts, Divisions, and Subdivisions.	Number of distinct Quartz Reefs proved to be Auriferous.	Extent in Square Miles of Auriferous Alluvial and Quartz Ground worked upon.
BEECHWORTH—<i>continued</i>—		
Big River Subdivision - - - - -	8	2½
Mitta-Mitta Division - - - - -	3	2½
Jamieson South Subdivision - - - - -	15	6
Totals - - - - -	561	166
SANDHURST—		
Sandhurst Division - - - - -	225	15½
Kilmore Division - - - - -	91	*26½
Heathcote Division and Waranga South Subdivision - - - - -	135	81½
Waranga North Subdivision - - - - -	89	10
Raywood Division - - - - -	35	56
Totals - - - - -	575	189½
MARYBOROUGH—		
Maryborough Division - - - - -	105	5
Amherst Division - - - - -	45	5½
Avoca Subdivision - - - - -	8	10
Dunolly and Tarnagulla Divisions - - - - -	172	16
Korong Division - - - - -	63	†11
Redbank and St. Arnaud South Subdivisions - - - - -	30	9½
St. Arnaud North Subdivision - - - - -	52	6½
Totals - - - - -	475	63½
CASTLEMAINE—		
Castlemaine Division - - - - -	93	9
Fryer's Creek Subdivision - - - - -	30	28½
Hepburn Division - - - - -	85	82
Taradale Subdivision - - - - -	19	15
Maldon Division - - - - -	74	9½
St. Andrew's Division - - - - -	60	13½
Kyneton Subdivision - - - - -	12	7
Blue Mountain North Subdivision - - - - -	5	8
Totals - - - - -	378	172½
ARARAT—		
Ararat Division - - - - -	18	33½
Pleasant Creek Division - - - - -	33	12
Barkly Division - - - - -	7	14
Raglan Division - - - - -	4	5½
Totals - - - - -	62	65
GIPPSLAND—		
Omeo Subdivision - - - - -	18	8
Mitchell River Subdivision - - - - -	9	3½
Crooked River Subdivision - - - - -	334	49½
Jericho Subdivision - - - - -	26	25
Donnelly's Creek Subdivision - - - - -	13	22½
Stringer's Creek Subdivision - - - - -	9	7
Russell's Creek Subdivision - - - - -	6	20
South Tarraville Subdivision - - - - -	—	—
Bendoc Subdivision - - - - -	10	15
Totals - - - - -	425	150½

* The extent of auriferous ground worked upon in the Kilmore Division was estimated by Mr. Meagher, the former mining registrar, at sixty square miles.

† The extent of auriferous ground worked upon in the Korong Division was estimated by Mr. Couchman, former mining registrar for that division, at sixteen square miles.

No. 27.

AVERAGE YIELD OF GOLD FROM CERTAIN PARCELS OF QUARTZ CRUSHED IN THE YEARS 1859 TO 1868
INCLUSIVE, FROM RETURNS MADE BY THE MINING SURVEYORS AND REGISTRARS.

Year.	Quantity Crushed.		Total Produce.		Average Yield per Ton.		
	Tons	cwts.	Ozs.	dwts.	Ozs.	dwts.	grs.
1859	39,034	0	47,524	14	1	4	8'4
1860	86,594	16	81,905	2	0	18	22
1861	350,409	0	299,482	13	0	17	2
1862	567,208	0	310,725	4	0	10	22
1863	523,226	0	323,190	14	0	12	8'5
1864	843,515	10	433,981	16	0	10	6'9
1865	705,134	0	419,325	3	0	11	21'4
1866	861,468	13	459,895	7	0	10	16'2
1867	948,850	12	498,677	12	0	10	12'2
1868	886,228	18	471,493	3	0	10	15'37
Totals	5,811,669	9	3,346,201	8	0	11	12'37

NOTE.—The above table does not show the total quantity of quartz crushed, but only the yield of certain "crushings," respecting which the mining surveyors and registrars have been able to obtain information. Owing to the circumstance that many of the machine-owners are unable to give, or are precluded from giving information, it is impossible to get complete returns from every district, and in considering the relative importance of each district, as regards quartz mining, the tables relating to machinery should be examined and compared. In 1859-60-61 it was not possible to get returns of any but the richer parcels.

No. 28.

TABLE SHOWING THE AVERAGE YIELD OF GOLD FROM CERTAIN PARCELS OF QUARTZ CRUSHED IN THE YEARS 1859 TO 1868 INCLUSIVE, IN THE SEVERAL MINING DISTRICTS, FROM RETURNS MADE BY THE MINING SURVEYORS AND REGISTRARS.

Mining District.	Year.	Quantity Crushed.		Total Produce.		Average Yield per Ton.		
		Tons	cwts.	Ozs.	dwt.	Ozs.	dwt.	grs.
BALLAARAT	1859	39,034	0	47,524	14	1	4	8'41
	1860	61,075	0	38,378	6	0	12	13
	1861	169,485	0	67,973	7	0	8	0
	1862	289,246	0	81,813	7	0	5	15
	1863	286,577	0	70,465	15	0	4	22
	1864	308,323	0	72,203	17	0	4	16'4
	1865	253,812	0	65,520	12	0	5	39
	1866	238,503	10	58,157	3	0	4	21
	1867	243,994	10	84,249	17	0	6	21'7
	1868	223,312	0	87,555	6	0	7	20'19
Totals	-	2,113,362	0	673,842	4	0	6	9'04
BEECHWORTH	1860	3,725	16	13,862	6	3	14	9
	1861	26,289	0	44,668	6	1	13	23
	1862	37,902	0	40,746	14	1	1	12
	1863	46,835	0	115,478	2	2	9	7
	1864	70,158	10	83,083	13½	1	3	16'4
	1865	85,598	10	119,460	15	1	7	21'8
	1866	130,519	11	118,495	19	0	18	3'7
	1867	113,994	9	72,958	3	0	12	19'2
	1868	113,557	15	78,845	19	0	13	21'27
Totals	-	628,580	11	687,599	17½	1	1	21'06
SANDHURST	1860	2,678	15	6,361	8	2	7	1
	1861	71,810	0	109,139	9	1	10	9
	1862	51,143	0	36,035	15	0	14	2
	1863	16,229	0	21,650	2	1	6	16
	1864	142,428	0	69,107	6	0	9	16'9
	1865	122,247	0	82,477	13	0	13	11'8
	1866	244,807	10	118,743	10	0	9	16'8
	1867	285,240	10	129,699	6	0	9	2'2
	1868	237,433	0	108,075	9	0	9	2'48
Totals	-	1,174,016	15	681,289	18	0	11	14'54

No. 28.—AVERAGE YIELD OF GOLD FROM CERTAIN PARCELS OF QUARTZ—continued.

Mining District.	Year.	Quantity Crushed.		Total Produce.		Average Yield per Ton.		
		Tons	cwts.	Ozs.	dwts.	Ozs.	dwts.	grs.
MARYBOROUGH -	1860	4,548	0	6,345	1	1	7	21
	1861	22,581	0	25,493	13	1	2	13
	1862	67,678	0	61,920	17	0	18	7
	1863	77,326	0	51,758	1	0	13	9
	1864	109,127	5	66,809	1½	0	12	5·8
	1865	86,158	0	47,051	12	0	10	22·1
	1866	79,552	12	44,967	14	0	11	7·3
	1867	86,865	12	44,570	1	0	10	6·2
	1868	89,116	15	44,512	14	0	9	23·75
Totals -	-	622,953	4	393,428	14½	0	12	15·14
CASTLEMAINE -	1860	13,301	15	14,955	11	1	2	11
	1861	48,769	0	40,991	5	0	16	19
	1862	72,726	0	55,620	19	0	15	7
	1863	74,659	0	52,787	17	0	14	3
	1864	167,122	5	116,852	0	0	13	23·6
	1865	117,674	0	77,705	12	0	13	4·9
	1866	124,374	10	85,662	3	0	13	18·5
	1867	132,280	10	76,174	10	0	11	12·4
	1868	121,590	0	54,490	14	0	8	23·11
Totals -	-	872,497	0	575,240	11	0	13	4·46
ARARAT -	1860	1,265	10	2,002	10	1	11	15
	1861	11,475	0	11,216	13	0	19	13
	1862	48,513	0	34,587	12	0	14	6
	1863	21,600	0	11,050	17	0	10	5
	1864	46,356	10	25,925	18	0	11	4·4
	1865	39,644	10	27,108	19	0	13	16·7
	1866	43,711	6	33,868	18	0	15	11·9
	1867	56,174	10	49,760	18	0	17	17·1
	1868	78,147	18	63,252	8	0	16	4·50
Totals -	-	346,887	18	258,774	13	0	14	22·07
GIPPSLAND -	1867	30,300	11	41,264	17	1	7	5·6
	1868	23,071	10	34,760	13	1	10	3·19
Totals -	-	53,372	1	76,025	10	1	8	11·73

No. 29.

AVERAGE YIELD OF GOLD FROM CERTAIN PARCELS OF QUARTZ TAILINGS, CEMENT, MULLOCK, ETC., CRUSHED IN THE YEARS 1864 TO 1868 INCLUSIVE; FROM RETURNS MADE BY THE MINING SURVEYORS AND REGISTRARS.

Year.	Quantity Crushed.		Total Produce.		Average Yield per Ton.		
	Tons	cwts.	Ozs.	dwts.	Ozs.	dwts.	grs.
1864	256,778	0	57,604	8	0	4	11'7
1865	196,421	16	45,814	19	0	4	16
1866	145,088	16	30,964	2	0	4	6'43
1867	199,737	10	37,869	7	0	3	19
1868	195,487	10	31,888	5	0	3	6'29
Totals	993,513	12	204,141	1	0	4	2'62

No. 30.

TABLE SHOWING THE AVERAGE YIELD OF GOLD FROM CERTAIN PARCELS OF QUARTZ TAILINGS, CEMENT, MULLOCK, ETC., CRUSHED IN THE YEARS 1864 TO 1868 INCLUSIVE, IN THE SEVERAL MINING DISTRICTS; FROM RETURNS MADE BY THE MINING SURVEYORS AND REGISTRARS.

Mining District.	Year.	Quantity Crushed.		Total Produce.		Average Yield per Ton.		
		Tons	cwts.	Ozs.	dwts.	Ozs.	dwts.	grs.
BALLAARAT	1864	51,566	0	4,412	9	0	1	17
	1865	16,618	0	1,850	11	0	2	5'5
	1866	8,768	6	1,275	12	0	2	21'8
	1867	8,452	0	1,133	19	0	2	16'3
	1868	7,004	0	1,027	3	0	2	22'39
Totals	-	92,408	6	9,699	14	0	2	2'38
BEECHWORTH	1864	1,497	0	209	2	0	2	19
	1865	73	6	19	18	0	5	10'1
	1866	2,775	0	534	14	0	3	20'4
	1867	771	0	208	8	0	5	9'7
	1868	2,788	10	443	15	0	3	4'38
Totals	-	7,904	16	1,415	17	0	3	13'97

No. 30.—YIELD OF GOLD FROM CERTAIN PARCELS OF QUARTZ TAILINGS, ETC.—continued.

Mining District.	Year.	Quantity Crushed.	Total Produce.	Average Yield per Ton.
		Tons cwts.	Ozs. dwts.	Ozs. dwts. grs.
SANDHURST	1864	82,659 0	20,167 5	0 4 21'1
	1865	97,193 0	18,328 17	0 3 18'5
	1866	69,402 0	13,284 6	0 3 19'8
	1867	93,685 0	17,423 7	0 3 17'2
	1868	98,653 0	15,919 13	0 3 5'45
Totals	-	441,592 0	85,123 8	0 3 20'52
MARYBOROUGH	1864	47,076 0	14,767 19	0 6 6'5
	1865	26,069 0	8,370 8	0 6 10'1
	1866	14,352 10	2,980 12	0 4 3'6
	1867	16,233 0	2,504 15	0 3 2
	1868	11,407 0	2,322 9	0 4 1'72
Totals	-	115,137 10	30,946 3	0 5 9'01
CASTLEMAINE	1864	59,577 0	13,881 19	0 4 15'83
	1865	35,771 10	13,153 10	0 7 8'5
	1866	33,001 0	9,617 16	0 5 19'8
	1867	52,476 10	8,901 15	0 3 9'4
	1868	57,531 0	7,948 13	0 2 18'31
Totals	-	238,357 0	53,503 13	0 4 11'74
ARARAT	1864	14,403 0	4,165 14	0 5 18'8
	1865	20,697 0	4,091 15	0 3 22'9
	1866	16,790 0	3,271 2	0 3 21'5
	1867	27,675 0	7,627 11	0 5 12'2
	1868	18,104 0	4,226 12	0 4 16'06
Totals	-	97,669 0	23,382 14	0 4 18'91
GIPPSLAND	1867	445 0	69 12	0 3 3
	1868	—	—	—
Totals	-	445 0	69 12	0 3 3

No. 31.

RETURN SHOWING APPROXIMATELY THE GOLD OBTAINED FROM QUARTZ VEINS AND ALLUVIAL WORKINGS DURING THE YEARS 1864 TO 1868 INCLUSIVE.

Year.	From Quartz Veins.		From Alluvial Workings.	
	Ozs.	dwt.	Ozs.	dwt.
1864	503,618	5	1,041,076	10
1865	450,000	0	1,093,801	0
1866	521,017	0	958,177	15
1867	560,527	0	873,160	6
1868	587,694	0	1,069,804	0

No. 32.

YIELD OF GOLD PER ANNUM.

Year.					Quantity Exported.	Value at 80s. per oz.
					Ozs.	£
1851 for three months	-	-	-	-	145,146	580,584
1852 - - - - -	-	-	-	-	2,218,782	8,875,128
1853 - - - - -	-	-	-	-	2,676,345	10,705,380
1854 - - - - -	-	-	-	-	2,150,730	8,602,920
1855 - - - - -	-	-	-	-	2,751,535	11,006,140
1856 - - - - -	-	-	-	-	2,985,991	11,943,964
1857 - - - - -	-	-	-	-	2,762,460	11,049,840
1858 - - - - -	-	-	-	-	2,528,478	10,113,912
1859 - - - - -	-	-	-	-	2,280,950	9,123,800
1860 - - - - -	-	-	-	-	2,156,660	8,626,640
1861 - - - - -	-	-	-	-	1,967,420	7,869,680
1862 - - - - -	-	-	-	-	1,658,207	6,632,828
1863 - - - - -	-	-	-	-	1,626,872	6,507,488
1864 - - - - -	-	-	-	-	1,544,694	6,178,776
1865 - - - - -	-	-	-	-	1,543,801	6,175,204
1866 - - - - -	-	-	-	-	1,479,194	5,916,776
1867 - - - - -	-	-	-	-	1,433,687	5,734,748
1868 - - - - -	-	-	-	-	1,657,498	6,629,992
Totals	-	-	-	-	35,568,450	142,273,800

NOTE.—To arrive at the total quantity exported it is necessary to add 1,267,241 ozs. to the above.

No. 33.

STATEMENT OF THE REVENUE DERIVED DIRECTLY FROM THE GOLDFIELDS IN EACH YEAR, FROM 1851 TO 1868 INCLUSIVE, COMPILED FROM THE TREASURY STATEMENTS OF REVENUE, ETC.

Year.	Gold Licences (including Store Licences).		Miners' Rights.		Business Licences.		Export Fees.		Treasury and Custody Fees.		Export Duty.		Leases of Gold and Mineral Lands.		Other Leases and Licences.		Other Gold Revenue.		Totals.	
	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.
1851	-	-	-	-	-	-	2,626	12 8	-	-	-	-	-	-	-	-	23	3 8	24,426	16 3
1852	-	-	-	-	-	-	39,706	17 8	-	-	-	-	-	-	-	-	-	-	438,845	10 0
1853	-	-	-	-	-	-	52,439	1 0	7,544	6 2	-	-	-	-	-	-	-	-	720,864	18 7
1854	-	-	-	-	-	-	56,657	12 4	5,506	7 1	-	-	-	-	-	-	101	17 10	457,668	16 10
1855	-	-	-	-	-	-	20,509	12 2	2,136	6 9	231,482	12 11	3,517	15 0	-	-	-	-	366,943	18 5
1856	-	-	-	-	-	-	964	12 6	1,278	1 6	376,292	14 2	2,220	8 2	-	-	-	-	466,997	11 11
1857	-	-	-	-	-	-	1,058	14 8	-	-	340,062	16 0	4,279	3 3	-	-	-	-	417,772	3 11
1858	-	-	-	-	-	-	473	0 8	-	-	320,910	18 5	107	5 0	-	-	-	-	390,442	4 1
1859	-	-	-	-	-	-	345	0 0	-	-	286,883	0 7	-	-	-	-	-	-	354,365	0 7
1860	-	-	-	-	-	-	148	10 3	-	-	268,323	4 8	7,136	17 2	-	-	-	-	338,492	12 1
1861	-	-	-	-	-	-	94	0 7	-	-	243,920	13 10	9,329	5 9	-	-	-	-	310,654	0 2
1862	-	-	-	-	-	-	-	-	-	-	184,521	6 1	5,240	8 5	-	-	-	-	235,707	14 6
1863	-	-	-	-	-	-	-	-	-	-	121,568	19 8	6,093	11 11	-	-	-	-	166,318	11 7
1864	-	-	-	-	-	-	-	-	-	-	115,697	8 6	8,306	7 6	-	-	-	-	162,240	16 0
1865	-	-	-	-	-	-	-	-	-	-	102,752	7 8	15,218	5 4	-	-	-	-	150,996	13 0
1866	-	-	-	-	-	-	-	-	-	-	81,912	1 2	13,621	12 2	410	7 5	-	-	113,394	1 3
1867	-	-	-	-	-	-	-	-	-	-	35,843	7 1	12,497	8 3	575	10 0	-	-	64,041	1 7
1868	-	-	-	-	-	-	-	-	-	-	-	-	13,136	10 0	920	13 4	-	-	34,013	8 4
Totals	-	-	-	-	-	-	1,517,023	4 10	16,463	1 6	2,712,120	10 9	100,704	17 11	1,906	10 9	125	1 6	5,211,465	19 1

NOTE.—The charges for Gold Licences were as follow:—Up to the 1st September, 1853, 30s. per month; from 1st September to 1st December, 1853, 40s. for three months; and from the 1st December, 1853, to the 11th June, 1855, as follows: for one month, £1; three months, £2; six months, £4; and for twelve months, £8.

Miners' Rights were issued from the 12th June, 1855, at £1 per annum; and from the 1st January, 1866, at 5s. per annum.

The charges for Business Licences were as follow:—From 1st December, 1853, for three months, £15; for six months, £25; and for twelve months, £50. From the 12th June, 1855, for three months, 50s.; for six months, £5; and for twelve months, £10. From the 1st January, 1866, for six months, £2 10s.; and for twelve months, £5.

The Export Duty on Gold was, from the 1st May, 1855, 2s. 6d. per oz.; from the 1st July, 1862, 2s. per oz.; from the 1st January, 1863, 1s. 6d. per oz.; from the 12th April, 1866, 1s.

per oz.; and from the 1st January to the 31st December, 1867, 6d. per oz., when it ceased to be collected.

The Leasing of Auriferous Lands was first provided for by 18 Vict. No. 37, clause 5; and the Regulations under that Act fixed the rents for alluvial lands at £10 per acre per annum; and for quartz lodes, at £1 per lineal yard of reef. No leases were issued under that Act; but during the years 1855 to 1858 deposits, on account of applications under the Regulations of 12th June, 1855, and 4th October, 1855, were received, to the amounts set down in the table. Under the Act 21 Vict. No. 34, leases were first issued. The rent charged up to 30th September, 1861, was—for alluvial land, £5 per acre per annum; and for lodes, £5 per 100 yards along the line of reef. From the 1st October, 1861, to the end of 1865, 50s. per acre per annum was the rent, whether for alluvial lands or quartz lodes; and from the 1st January, 1866, the rent has been £1 per acre per annum.

No. 34.

TABLE SHOWING THE WAGES PAID PER WEEK FOR DIFFERENT KINDS OF LABOR IN THE SEVERAL DIVISIONS AND SUBDIVISIONS OF EACH MINING DISTRICT DURING THE YEAR 1868, FROM RETURNS MADE BY THE MINING SURVEYORS AND REGISTRARS.

Mining Districts, Divisions, and Subdivisions.	General Manager.	Legal Manager.	Mining Manager.	Engineer.	Engine-driver.	Pitman.	Black-smith.	Carpenter.	Foreman of Shift.	Miners.	Surface Men (Laborers).	Boys.	Chinese.
BAIKALBAT—													
Central Division -	\$ 4. d. 5 10 0	\$ 4. d. 3 0 0	\$ 4. d. 4 10 0	\$ 4. d. 5 0 0	\$ 4. d. 2 10 0	\$ 4. d. 3 5 0	\$ 4. d. 3 10 0	\$ 4. d. 3 5 0	\$ 4. d. 2 12 6	\$ 4. d. 2 2 0	\$ 4. d. 2 2 0	\$ 4. d. 1 7 6	\$ 4. d. 1 7 6
Southern Division -	-	-	-	-	-	-	-	-	-	-	-	-	-
Buninyong Division -	5 0 0	4 0 0	4 10 0	3 10 0	2 10 0	2 10 0	2 10 0	3 0 0	2 18 0	2 5 0	2 8 0	1 5 0	1 10 0
	5 0 0	3 0 0	4 10 0	3 0 0	2 10 0	2 10 0	2 10 0	3 0 0	2 10 0	2 5 0	2 5 0	1 2 6	1 7 6
	5 10 0	4 0 0	6 0 0	3 15 0	2 15 0	3 10 0	5 10 0 ^b	5 10 0 ^b	3 0 0	3 0 0	2 5 0	1 15 0	1 15 0
Smythesdale Division -	4 10 0	2 0 0	4 0 0	3 5 0	2 10 0	-	3 0 0	2 10 0	2 15 0	2 5 0	2 5 0	1 18 0	1 15 0
	6 0 0	5 0 0	4 10 0	3 10 0	2 12 0	-	3 10 0	3 6 0	2 10 0	2 10 0	2 10 0	2 0 0	2 0 0
Creswick Division -	6 0 0	1 0 0	4 0 0	3 12 0	2 10 0	4 4 0	2 10 0	2 10 0	2 10 0	2 5 0	2 0 0	1 0 0	1 10 0
	15 10 0	7 0 0	11 10 0	7 14 0	3 15 0	5 10 0	3 12 0	3 12 0	2 15 0	2 10 0	2 10 0	1 10 0	1 15 0
Gordon Subdivision -	7 0 0	3 0 0	3 12 0	3 19 0	2 10 0	-	2 12 0	2 18 0	2 13 0	2 7 0	2 5 0	1 10 0	-
Steiglitz Subdivision -	5 0 0	2 10 0	3 10 0	-	2 10 0	-	2 10 0	2 14 0	2 10 0	2 10 0	2 5 0	1 10 0	-
	-	-	4 0 0	-	3 0 0	-	3 0 0	-	-	2 5 0	2 10 0	-	-
Blackwood Division -	-	-	5 0 0	3 10 0	2 10 0	-	2 10 0	-	-	2 5 0	2 10 0	1 0 0	-
	-	-	-	-	-	-	2 15 0	-	-	2 10 0	-	1 5 0	-
Blue Mountain South Subdivision	-	-	-	-	-	-	-	-	-	-	-	-	-
BEECHWORTH—													
Beechworth Subdivision -	6 10 0	1 0 0	3 0 0	-	3 0 0	-	2 10 0	2 10 0	-	2 0 0	2 0 0	1 0 0	1 10 0
	-	4 10 0	5 0 0	-	-	-	3 0 0	3 0 0	-	3 0 0	2 10 0	-	1 10 0
Stanley Subdivision -	4 10 0	-	-	-	-	-	-	3 12 0	-	3 0 0	2 5 0	-	1 10 0
Yackandandah Subdivision -	6 0 0	1 10 0	6 0 0	-	3 0 0	2 10 0	3 0 0	2 10 0	3 0 0	2 10 0	2 10 0	2 0 0	1 10 0
Sandy Creek Subdivision -	-	-	-	-	-	-	2 10 0	2 10 0	-	-	2 2 0	1 10 0	1 5 0
Indigo Division -	5 0 0	2 0 0	4 10 0	4 0 0	2 15 0	-	3 10 0	2 15 0	3 0 0	2 15 0	2 5 0	2 0 0	-
	-	3 0 0	5 0 0	4 0 0	3 0 0	3 0 0	4 0 0	3 0 0	3 0 0	2 10 0	2 10 0	2 2 0	-
Buckland Division -	6 0 0	-	5 0 0	4 0 0	3 0 0	3 0 0	3 0 0	3 0 0	3 0 0	2 10 0	2 10 0	1 10 0	1 10 0
	-	-	-	4 10 0	3 10 0	-	4 0 0	3 10 0	-	3 0 0	3 0 0	1 10 0	-
Jamieson North Subdivision	10 10 0 ^c	1 0 0	4 0 0	-	3 0 0	-	-	-	2 15 0	2 10 0	2 10 0	1 10 0	-

Gaffney's Creek Subdivision	-	-	-	5 0 0	1 0 0	4 0 0	6 0 0	3 10 0	-	3 10 0	3 0 0	3 10 0	3 0 0	3 0 0	2 0 0	2 0 0
Wood's Point Subdivision	-	-	-	7 0 0	4 0 0	4 10 0	5 0 0	4 0 0	3 0 0	4 0 0	4 0 0	3 10 0	3 0 0	3 0 0	-	2 10 0
Big River Subdivision	-	-	-	4 0 0	1 5 0	4 0 0	5 0 0	3 15 0	-	3 10 0	4 0 0	3 5 0	3 0 0	3 0 0	-	-
Mitta-Mitta Division	-	-	-	5 0 0	1 5 0	4 0 0	5 0 0	4 0 0	-	4 0 0	4 0 0	4 10 0	3 5 0	3 0 0	-	-
Jamieson South Subdivision	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SANDHURST—																
Sandhurst Division	-	-	-	6 0 0	0 15 0	4 0 0	2 15 0	2 10 0	2 10 0	2 10 0	3 0 0	2 10 0	2 5 0	2 5 0	0 12 0	-
Kilmore Division	-	-	-	7 13 10	5 0 0	5 0 0	5 0 0	3 10 0	3 0 0	3 10 0	3 12 0	3 10 0	3 10 0	2 5 0	1 15 0	-
Headbroke Division and Waranga South Sub-division	-	-	-	-	1 0 0	3 0 0	2 10 0	2 5 0	2 0 0	2 10 0	2 10 0	2 10 0	2 7 6	2 0 0	1 10 0	1 10 0
Waranga North Subdivision	-	-	-	1 0 0	1 0 0	4 10 0	3 10 0	3 10 0	3 0 0	3 10 0	3 0 0	3 0 0	2 10 0	2 5 0	1 10 0	2 0 0
Raywood Division	-	-	-	4 0 0	-	4 10 0	4 0 0	3 0 0	3 0 0	3 10 0	3 0 0	2 15 0	2 10 0	2 5 0	1 10 0	-
MARYBOROUGH—																
Maryborough Division	-	-	-	3 3 0	1 10 0	3 10 0	3 0 0	2 10 0	2 10 0	2 15 0	2 15 0	2 10 0	2 5 0	2 0 0	1 5 0	1 10 0
Amherst Division	-	-	-	-	-	3 0 0	2 2 0	2 2 0	-	2 10 0	3 0 0	-	2 0 0	2 0 0	1 10 0	-
Arco Subdivision	-	-	-	4 0 0	1 10 0	5 0 0	5 0 0	2 10 0	3 0 0	3 0 0	3 0 0	3 0 0	2 5 0	2 5 0	1 16 0	1 10 0
DUNDOLLY AND TERNAGULLA DIVISIONS																
Korong Division	-	-	-	6 0 0	2 0 0	3 0 0	4 0 0	3 0 0	3 0 0	3 0 0	3 0 0	3 0 0	2 10 0	2 0 0	0 10 0	-
Redbank and St. Arnaud South Subdivisions	-	-	-	3 10 0	0 10 0	3 5 0	3 5 0	3 0 0	2 10 0	2 10 0	2 10 0	-	2 5 0	2 0 0	-	-
St. Arnaud North Subdivision	-	-	-	-	2 0 0	4 0 0	-	3 0 0	-	2 10 0	2 10 0	3 0 0	2 5 0	2 10 0	0 15 0	-
CASTLEMAINE—																
Castlemaine Division	-	-	-	4 0 0	1 10 0	4 0 0	2 5 0	2 5 0	3 0 0	2 5 0	2 10 0	2 5 0	2 0 0	1 10 0	0 12 0	0 12 0
Fryer's Creek Subdivision	-	-	-	6 0 0	-	-	3 0 0	2 10 0	2 7 6	2 10 0	-	2 8 0	2 5 0	2 5 0	1 10 0	0 15 0
Hopburn Division	-	-	-	-	-	-	3 0 0	2 5 0	2 5 0	2 5 0	3 0 0	2 5 0	2 0 0	2 0 0	1 0 0	1 10 0
	-	-	-	-	-	-	4 0 0	2 10 0	-	3 0 0	2 10 0	2 10 0	2 5 0	2 5 0	1 15 0	-
	-	-	-	-	-	-	3 0 0	2 5 0	-	2 10 0	2 10 0	2 10 0	2 5 0	2 5 0	0 15 0	-
	-	-	-	-	-	-	5 10 0	3 0 0	-	3 0 0	3 0 0	2 10 0	2 5 0	2 5 0	1 10 0	-

† General manager, acting also as mining manager and engineer.

• Blacksmith, also acting as engineer.

No. 34.—TABLE SHOWING THE WAGES PAID PER WEEK FOR DIFFERENT KINDS OF LABOR, ETC.—continued.

Mining Districts, Divisions, and Subdivisions.	General Manager.	Legal Manager.	Mining Manager.	Engineer.	Engine-driver.	Pitman.	Black-smith.	Carpenter.	Foreman of Shift.	Milburn.	Surface Men (Laborers).	Boys.	Chinese.
CARBONATE—continued—	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.	\$ s. d.
Tandale Subdivision - - - - -	-	3 10 0	4 0 0	3 0 0	2 5 0	2 5 0	2 10 0	2 10 0	-	2 5 0	2 5 0	1 5 0	-
Maldon Division - - - - -	-	4 0 0	5 0 0	3 10 0	3 0 0	3 0 0	3 0 0	3 0 0	3 5 0	2 10 0	2 2 0	1 10 0	-
St. Andrew's Division - - - - -	4 0 0	2 0 0	4 0 0	4 0 0	2 10 0	2 0 0	2 8 0	2 8 0	4 0 0	2 0 0	2 5 0	1 0 0	0 15 0
Kynston Subdivision - - - - -	5 0 0	3 0 0	5 0 0	4 10 0	3 10 0	3 0 0	4 0 0	3 0 0	5 0 0	3 0 0	3 0 0	1 0 0	-
Blue Mountain North Subdivision - - - - -	4 0 0	-	3 10 0	3 0 0	2 10 0	-	-	-	-	2 5 0	2 5 0	1 5 0	-
ARABAT—	-	-	4 0 0	3 5 0	2 10 0	2 8 0	3 0 0	3 0 0	2 15 0	2 8 0	2 8 0	1 0 0	-
Ararat Division - - - - -	-	1 0 0	4 0 0	3 15 0	3 10 0	-	3 0 0	3 0 0	3 0 0	2 10 0	2 0 0	1 0 0	-
Pleasant Creek Division - - - - -	-	5 0 0	5 10 0	4 10 0	4 0 0	2 10 0	3 10 0	2 10 0	3 10 0	2 10 0	2 5 0	0 15 0	-
Barkly Division - - - - -	-	2 0 0	3 0 0	6 0 0	3 10 0	2 10 0	4 10 0	2 10 0	-	2 10 0	2 5 0	1 5 0	2 0 0
Beglan Division - - - - -	-	-	3 10 0	4 10 0	4 0 0	2 10 0	4 0 0	2 12 0	-	2 5 0	2 5 0	0 15 0	-
GIRIELAND—	-	-	-	-	-	-	-	-	-	-	-	-	-
Onase Subdivision - - - - -	5 0 0	1 0 0	4 0 0	4 0 0	3 0 0	3 0 0	4 0 0	4 0 0	3 10 0	3 0 0	2 10 0	1 10 0	2 0 0
Mitchell River Subdivision - - - - -	-	-	-	-	-	-	-	-	-	2 10 0	-	-	-
Crooked River Subdivision - - - - -	4 0 0	2 0 0	4 0 0	3 10 0	3 10 0	-	4 0 0	3 10 0	3 10 0	3 0 0	-	-	-
Jericho Subdivision - - - - -	-	4 0 0	6 0 0	4 0 0	4 0 0	3 0 0	4 0 0	4 0 0	3 0 0	3 0 0	3 0 0	-	-
Donnelly's Creek Subdivision - - - - -	6 0 0	2 0 0	4 0 0	5 10 0	3 10 0	3 0 0	4 10 0	5 0 0	4 0 0	3 0 0	3 0 0	-	-
Stringer's Creek Subdivision - - - - -	2 10 0	2 0 0	5 0 0	4 10 0	3 10 0	-	4 0 0	4 0 0	3 10 0	3 0 0	3 0 0	1 10 0	-
Baswell's Creek Subdivision - - - - -	10 0 0	-	8 0 0	5 0 0	4 0 0	-	4 10 0	4 0 0	-	3 0 0	2 10 0	-	-
South Tarraville Subdivision - - - - -	-	-	6 0 0	5 0 0	4 0 0	-	4 10 0	4 0 0	-	-	-	-	-

No. 35.

THE PRICES OF MINING MATERIALS IN THE MORE IMPORTANT MINING CENTRES,
31ST DECEMBER, 1868.

Ballaarat.—Castings: Iron puddling machines, 15s. per cwt.; iron harrows, 15s. per cwt.; lift pumps, from 6 inches to 22 inches, including workings and connections, £1 1s. per cwt.; winding and pumping gear, £1 6s. per cwt., water pipes, 13s. per cwt.; stamping batteries with iron frames and fittings connected with ten stamps, say 10 cwt. per head or per stamp or hammer, according to construction or design, 40-inch iron with wood framing, £30 to £35; gas pipes, $\frac{3}{4}$ -inch to 2-inch, 4d. to 1s. 6d. per foot; iron rivets, £1 8s. to £2 10s. per cwt.; chains, round sizes, $\frac{1}{8}$ to 1-inch, imported, £1 2s. to £2 5s. per cwt., made at Ballaarat, £1 17s. 4d. to £5 12s. per cwt. Rope: Flat wire, 3-inch by $\frac{3}{8}$ -inch to 4-inch by $\frac{3}{8}$ -inch, £3 5s. to £3 15s. per cwt.; flat hemp, $4\frac{1}{2}$ -inch to 6-inch, £3 14s. per cwt.; round manilla, different sizes, £3 5s. per cwt. Powder, glazed blasting, £2 10s. to £2 14s. per 100 lbs. Fuze: Single tape, 9s. per doz. coils; double tape, 12s. to 13s. per doz. coils. Candles, sperm, 12s. per doz. lbs. Oil: olive, 6s. 6d. to 7s. per gal.; colza, 5s. 6d. per gal.; castor, 6s. 6d. to 7s. per gal.; kerosene, 2s. 9d. per gal. Tallow, beef and mutton, £1 17s. 4d. per cwt. Quicksilver, 2s. 3d. per lb. Picks: single-ended, driving and sinking, £2 8s. to £2 14s. per doz.; double-ended, £2 8s. to £3 per doz. Pick hilt, &c., hickory, 13s. to 15s. per doz.; colonial light-wood, 6s. to 10s. 6d. per doz. Shovels: long-handled, £3 to £4 per doz.; D-handled, £2 8s. to £3 16s. per doz.; Cornish socket-handled, £2 14s. per doz. Shovel handles, English, 18s. per doz.; colonial, 10s. to 12s. per doz. White yarn: flax packing, 1s. 4d. to 1s. 6d. per lb.; hemp packing, 10d. to 1s. 1d. per lb. Iron: common, 14s. per cwt.; best, Low Moor, £1 12s. to £1 17s. 4d. per cwt. Leather: colonial, for pumps, 1s. to 2s. per lb.; English, 2s. 3d. to 3s. per lb.; belt leather, colonial, 2s. per lb. Gutta-percha: sheet, for pump clacks, 3s. 3d. per lb.; tubing, &c., 4s. to 4s. 6d. per lb. Steel: cast, £2 16s. to £3 5s. 4d. per cwt.; blister, £1 12s. to £2 16s. per cwt.; shear, £3 5s. 4d. per cwt.; spring, £1 17s. 4d. per cwt.; Stubbs No. 2, £3 14s. 8d. per cwt.

Creswick.—Castings: stamp-heads and beds, 15s. to 17s. per cwt.; wheels, &c., £1 4s. per cwt. Hemp rope, 3 to 8-inch, £3 6s. 8d. per cwt. Blasting powder, 6d. to 8d. per lb. Fuze, 12s. to 13s. per doz. coils. Candles, 13s. per doz. lbs. Oil: colza, 6s. 6d. per gal.; machine, 6s. 6d. per gal. Tallow, £1 11s. 3d. to £1 17s. 6d. per cwt. Quicksilver, 2s. to 2s. 2d. per lb. Picks, £2 8s. to £3 12s. per doz. Pick handles, 11s. to 16s. per doz. Shovels, long-handled, £3 to £4 4s. per doz. Leather, English, for pumps, 2s. 6d. per lb. Cotton waste, 7 $\frac{1}{2}$ d. to 8d. per lb. Iron, common, 16s. per cwt. Steel: cast, £3 5s. per cwt.; blister, £2 16s. Sheet indiarubber, 4s. to 4s. 3d. per lb.

Buckland.—Castings, plain, without extra work after being taken out of the sand, £1 8s. per cwt. Chain, smaller sizes, £2 12s. per cwt. Hemp and wire rope, £4 per cwt. Powder, coarse, for blasting, £3 6s. 8d. per 100 lbs. Indiarubber fuze, double, 15s. per doz. coils. Sperm candles, 16s. per doz. lbs. Oil: colza, 8s. per gal.; olive, 9s. per gal.; Chinese, 7s. per gal.; kerosene, 5s. 6d. per gal. Quicksilver, 3s. per lb. Picks: double-ended, £4 16s. per doz.; single-ended, £4 10s. per doz. Pick handles, £1 2s. per doz. Shovels, £4 4s. to £4 16s. per doz. Leather: colonial, 2s. 4d. per lb.; English, 3s. 6d. per lb. Iron, common, £1 12s. 8d. per cwt. Steel, cast, £4 14s. 4d. per cwt.; blister, £4 4s. per cwt. Carriage from Melbourne about £8 10s. per ton.

Wood's Point.—Castings of white metal (hematite), stamp-heads, &c., £1 12s. per cwt. Rope: Manilla, £4 4s. per cwt.; extra thickness, £4 10s. per cwt. Powder, best patent glazed, per 100 lbs., £4 4s. Fuze, 14s. per doz. coils. Candles, Neva, 16s. per doz. lbs. Oil: castor, 10s. per gal.; olive, 11s. per gal. Quicksilver, 2s. 8d. per lb. Picks, mining picks (heads), 18s. per doz. lbs. Pick handles, £1 per doz. Shovels: long-handled, £5 5s. per doz.; short-handled, £4 4s. per doz. Leather, belting and grain, 1s. 6d. per lb. Vulcanized indiarubber belting, 5 inches wide, four-ply, 4s. per foot. Iron, best, £1 17s. 4d. per cwt. Steel: cast, £3 16s. per cwt.; blister, £3 12s. per cwt.

Sandhurst.—Castings: Stamp heads, shoes and bottoms, 17s. per cwt.; general work, £1 per cwt. Chains: Round's patent flat, not used (too heavy), often requires mending; ordinary, £2 per cwt. Rope, Manilla, 3-inch to 6-inch, £3 10s. per cwt. Powder, Hall's, £2 16s. 3d. per cwt. Fuze, Bickford and Co.'s double tape (by the cask), 11s. 6d. per doz. coils. Candles, sperm, 12s. to 14s. per doz. lbs. Oil: kerosene, 2s. 9d. per gal.; neatsfoot, 6s. 6d. per gal.; other oil (average), 7s. per gal. Tallow, beef and mutton, mixed specially for machine purposes, £1 8s. per cwt. Quicksilver, 2s. 2d. per lb. Picks, hammer-headed, £2 2s. per doz. Pick hilts (colonial wood), 9s. per doz. Shovels, American, long-handled, Amess' No. 3, £4 10s. per doz.; Carr's, £3 10s. per doz. Leather: colonial sides (good), 1s. 2d. per lb.; English butts, 2s. 3d. to 3s. 3d. per lb. White yarn for lamps, 3s. 6d. per lb. Cotton waste for cleaning, 7d. to 9d. per lb. Hemp, flax for packing, £9 16s. (some at £6) per cwt. Iron, best, 17s. per cwt. Steel, £2 18s. per cwt.; blister, £2 16s. per cwt. Gun-cotton, 15s. 6d. per box of 125 charges.

Maryborough.—Castings, whim and truck wheels, £1 5s. per cwt. Chains, short links, $\frac{3}{8}$ -inch to 1-inch, £2 per cwt. Rope, Manilla, $\frac{1}{2}$ -inch to 6-inch, £3 10s. per cwt. Powder, blasting, £3 7s. per 100 lbs. Fuze, double tape, 13s. per doz. coils. Candles, sperm, 12s. per doz. lbs. Oil: colza, 7s. per gal.; castor, 7s. 6d. per gal.; olive, 8s. 6d. per gal. Tallow: mutton, £1 16s. per cwt.; beef, £1 10s. to £1 16s. per cwt. Quicksilver, 2s. 6d. per lb. Picks, driving and sinking, single ends, weight 3 to 6 lbs., £1 10s. to £3 per doz. Pick hilts, &c., colonial principally, 9s. per doz. Shovels, American principally, £3 6s. to £3 12s. per doz. Leather, English hide, 2s. 7d. per lb. Iron, best B.B.H., 18s. per cwt. Steel: cast, £3 5s. 4d. per cwt.; blister, £2 7s. per cwt.; shear, £2 16s. per cwt.

Castlemaine.—Castings: for stamping batteries, 18s. per cwt.; wheels, £1 3s. per cwt.; pipes, 14s. to £1 per cwt. Rope, Manilla, £3 19s. per cwt. Powder, blasting, £3 2s. 6d. per 100 lbs. Fuze, double tape, 13s. per doz. coils. Candles, sperm, 13s. 6d. per doz. lbs. Oil: colza, 8s. per gal.; olive, 9s. per gal.; castor, 7s. 6d. per gal. Tallow, £2 16s. per cwt. Quicksilver, 2s. 4d. per lb. Picks, driving, £2 8s. per doz. Pick hilts, &c, 16s. per doz. Shovels: American, £3 5s. per doz.; Cornish, 11d. per lb. Leather: colonial, 1s. to 1s. 1d. per lb.; English, 3s. per lb. Cotton waste, 9d. per lb. Hemp, packing, 2s. per lb. Iron, B.B.H., 17s. per cwt. Steel: cast, £3 10s. per cwt.; blister, £2 16s. per cwt.

Maldon.—Castings, stamp-heads, 18s. to £1 per cwt. Chains, common, $\frac{3}{8}$ -inch to $\frac{7}{8}$ -inch, £2 2s. per cwt. Rope, Manilla, 8-inch, £3 8s. per cwt. Powder, Hall's, £3 2s. 6d. per 100 lbs. Fuze, Bickford's, 13s. per doz. coils. Candles: tallow, 1s. 4d. per lb.; sperm, 14s. per doz. lbs. Oil: colza, 6s. 9d. per gal.; castor, 6s. 6d. per gal. Tallow, mutton and beef, £1 17s. 4d. per cwt. Quicksilver, 2s. 6d. per lb. Picks, hammer-headed, 10d. per lb. Pick hilts, 9s. to 12s. per doz. Shovels: long-handled, £3 18s. per doz.; English, short-handled, £3 6s. per doz. Leather, English

hide, 2s. 6d. per lb. Cotton waste, 1s. per lb. Hemp, engine packing, £11 4s. per cwt. Iron, 18s. per cwt. Steel: cast, £2 16s. per cwt.; blister, £2 16s. per cwt.

Ararat.—Castings, fire bars, truck wheels, &c., £1 5s. per cwt. Rope, Manilla, 7-inch, £3 14s. 6d. per cwt. Powder, blasting, £2 15s. per cwt. Fuze, 14s. per doz. coils. Candles, stearine, 13s. per doz. lbs. Oil: colza, 6s. 6d. per gal.; olive, 7s. per gal.; kerosene, 2s. 8d. per gal. Tallow, beef, £1 18s. per cwt. Picks, common driving, £2 2s. per doz. Pick handles, sheoak, 7s. 6d. per doz. Shovels, short-handled, £3 6s. per doz. Leather, English butts, £2 15s. Hemp, £7 15s. per cwt. Iron, best wrought, 16s. 6d. per cwt. Steel, cast, £2 15s. per cwt.

No. 36.

WEIGHT OF STAMP-HEADS, ETC.

The following particulars, which have been collected by the mining surveyors and registrars, relate to the weight and cost of the stamp-heads and shanks or lifters made use of in some of the principal gold mines in the several mining districts, and supply additional information connected with the process of crushing quartz.

In the *Ballaarat Mining District* the stamp-heads, with shanks or lifters, vary in weight from 3 cwt. 1 qr. to 8 cwt., and the cost is from £4 5s. to £17. The height the stamp-head falls ranges from seven to ten inches. The number of strokes made by stamp-head per minute is from fifty to eighty. The quantity of quartz crushed per head per diem of twenty-four hours varies from 18 cwt. to 3 tons 10 cwt. The number of holes per square inch in the gratings used is from 40 to 224. (The latter number is made use of by the New North Clunes Company, at Clunes.) The horse-power required to work each stamper is from 1 to 1.5. The quantity of water used per stamp-head in crushing varies from 220 gallons to 600 gallons per hour. The quantity of mercury used in the ripples per stamper is from 5 to 110 lbs. (The latter quantity is used by the New North Clunes Company, at Clunes.) The quantity of mercury lost per stamp-head per week varies from *nil* to 8 ozs.

In the *Beechworth Mining District* the stamp-heads, with shanks or lifters, vary in weight from 4 cwt. to 7 cwt. 3 qrs., and the cost is from £6 to £23 12s. per head. The height the stamp-head falls ranges from five to sixteen inches. The number of strokes made per minute is from forty-five to eighty. The quantity of quartz crushed per head per diem of twenty-four hours varies from 1 ton to 4 tons. The number of holes per square inch in the gratings used is from 65 to 144. The horse-power required to work each stamper is from 0.75 to 2. The quantity of water used per stamp-head in crushing varies from 70 to 480 gallons per hour. The quantity of mercury used in the ripples per stamper is from 5 to 70 lbs. The quantity of mercury lost per stamp-head per week varies from *nil* to 8 ozs. (One engine is reported to use as much as 1,800 gallons of water per stamp-head per hour, but this appears to be excessive.)

In the *Sandhurst Mining District* the stamp-heads, with shanks or lifters, vary in weight from 5 cwt. to 8 cwt., and the cost is from £5 to £20. The height the stamp-head falls ranges from eight and a-half to eighteen inches. The number of strokes made per minute is from forty-five to seventy-two. The quantity of quartz crushed per head per diem of twenty-four hours varies from 15 cwt. to 3 tons. The number

of holes per square inch in the gratings used is from 64 to 130. The horse-power required to work each stamper is from 0.75 to 1. The quantity of water used per stamp-head in crushing varies from 211 gallons to 515 gallons per hour. The quantity of mercury used in the ripples per stamper is from 10 to 40 lbs. The quantity of mercury lost per stamp-head per week varies from *nil* to $4\frac{1}{2}$ ozs.

In the *Maryborough Mining District* the stamp-heads, with shanks or lifters, vary in weight from 4 cwt. to 7 cwt. 2 qrs., and the cost is from £6 to £20. The height the stamp-head falls ranges from eight to twelve inches. The number of strokes made per minute is from sixty to eighty. The quantity of quartz crushed per head per diem of twenty-four hours varies from $1\frac{1}{2}$ tons to 3 tons. The number of holes per square inch in the gratings used is from 60 to 140. The horse-power required to work each stamper is from 0.83 to 1.75. The quantity of water used per stamp-head in crushing varies from 200 to 1,166 gallons per hour. The quantity of mercury used in the ripples per stamper is from 12 to 25 lbs. The quantity of mercury lost per stamp-head per week varies from $\frac{1}{2}$ oz. to 8 ozs.

In the *Castlemaine Mining District* the stamp-heads, with shanks or lifters, vary in weight from 2 cwt. 2 qrs. to 7 cwt. 2 qrs., and the cost is from £3 to £40. The height the stamp-head falls ranges from six to fifteen inches. The number of strokes made per minute is from thirty-five to eighty. The quantity of quartz crushed per head per diem of twenty-four hours varies from 1 ton to 4 tons. The number of holes per square inch in the gratings used is from 64 to 160. The horse-power required to work each stamper is from 0.5 to 2. The quantity of water used per stamp-head in crushing varies from 27 to 650 gallons per hour. A few machines are reported to use less water than the minimum here given. The quantity of mercury used in the ripples per stamper is from 6 lbs. to $37\frac{1}{2}$ lbs. The quantity of mercury lost per stamp-head per week varies from *nil* to 8 ozs.

In the *Ararat Mining District* the stamp-heads, with shanks or lifters, vary in weight from 5 cwt. to 7 cwt., and the cost is from £5 to £10. The height the stamp-head falls ranges from six to ten inches. The number of strokes made per minute is from sixty to eighty. The quantity of quartz crushed per head per diem of twenty-four hours varies from 1 ton 5 cwt. to 1 ton 10 cwt. The number of holes per square inch in the gratings used is from 100 to 121. The horse-power required to work each stamper is from 0.6 to 1.5. The quantity of water used per stamp-head in crushing varies from 120 to 480 gallons per hour. The quantity of mercury used in the ripples per stamper is from 6 to 47 lbs. The quantity of mercury lost per stamp-head per week varies from $1\frac{1}{2}$ ozs. to 8 ozs.

In the *Gippsland Mining District* the stamp-heads, with shanks or lifters, vary in weight from 3 cwt. to 8 cwt., and the cost is from £6 to £17 12s. (N.B.—In one engine the weight of each stamp-head, with shank or lifter, is one ton, the cost £90, and the nominal horse-power required per stamp-head 0.75.) The height the stamp-head falls ranges from seven to eleven inches. The number of strokes made per minute is from seventy to eighty. The quantity of quartz crushed per head per diem of twenty-four hours varies from 1 ton 10 cwt. to 2 tons 1 cwt. The number of holes per square inch in the gratings used is from 70 to 250. (The latter number is made use of by the Good Hope Company, at Crooked River.) The horse-power required to work each stamper is from 0.83 to 1.87. The quantity of water used per stamp-head in crushing varies from 120 to 390 gallons per hour. The quantity of mercury used in the ripples per stamper is from 12 to 40 lbs. The quantity of mercury lost per stamp-head per week varies from 1 oz. to 5 ozs.

No. 37.

COST OF CRUSHING QUARTZ, ETC.

The following information has been obtained from one or more mining companies in some of the more important mining centres, relative to the cost per ton of raising cement, washdirt, and quartz, and of extracting the gold; the proportionate cost of mining materials used to the wages paid, and the cost of engines (per hour) employed in pumping, puddling, crushing, and winding, &c.

At Ballaarat, the average cost of raising and puddling washdirt and getting out the gold in several mining companies is 7s. 3d. per ton, and the cost in two companies of puddling and sluicing is 1s. 7½d. per ton.

The average cost of raising quartz, and delivering it at the machines in two mining companies is 5s. 10½d. per ton, and of crushing quartz and extracting the gold is 2s. 10d. per ton. The proportionate cost of the mining materials used in one mining company to the wages paid is two-fifths. And the average cost per hour of an engine engaged in pumping and puddling is 25s., in winding and puddling is 6s. 7d., and in winding, pumping, and puddling is 9s. 4½d.

At Clunes, the average cost, in one alluvial mine, of puddling is 10½d. per ton; and the average cost of sluicing is 3½d. per ton.

The average cost of raising and delivering quartz at the machine in one mine is 12s. 10d. per ton, and in another mine is 27s. 1d. per ton. The average cost per ton of crushing quartz and extracting the gold is 7s. 5d. in the first mentioned quartz mine; and the proportionate cost of the mining materials used to the wages paid is one-third.

At Bright, the average cost of raising quartz and delivering it at the machine is 2s. 2d. per ton; the average cost of crushing the quartz and extracting the gold is 2s. 2d. per ton; the average cost per hour of a pumping engine is 2s., of a crushing engine 2s., and of a winding engine 1s. 7d. per hour.

At Wood's Point, the average cost, in three quartz mines, of raising quartz and delivering it at the machine is 8s. per ton; the average cost of crushing quartz and extracting the gold by steam-power is 3s. 6d. per ton, and by water-power is 1s. 7½d. per ton. The proportionate cost of the mining materials used to the wages paid is nearly one-fourth. The average cost per hour of a pumping and winding engine is 3s. 3d.; and of two crushing engines is 3s. 4d. per hour.

At Sandhurst, the average cost of raising cement is 3s. 6d. per ton; the average cost of carting, crushing, and extracting the gold is 8s. per ton; and the average cost of puddling or sluicing is 3s. per ton, including cartage.

The average cost in one quartz mine of raising quartz and delivering it at the machine is 8s. 10½d. per ton; the average cost of crushing quartz and extracting the gold is 2s. 9½d. per ton; the proportionate cost of the mining materials used to the wages paid is less than one-sixth; and the average cost per hour of the crushing engine is 11s., and of the winding engine is 4s.

At Maryborough, the average cost, in three companies, of raising cement is 21s. 8d. per ton; the average cost of puddling is 2s. 6d. per ton.

The average cost, in three quartz mines, of raising quartz is 21s. 8d. per ton; the average cost of crushing quartz and extracting the gold is 8s. per ton with stampers, and 11s. per ton with stampers and Chilian mills. The proportionate cost of the

mining materials used to the wages paid is one-fourth. The average cost per hour of puddling engines is 1s. 6d. ; and of crushing and winding, 2s. 6d.

At Castlemaine, the average cost, in one claim, of breaking cement is 21s. per ton ; the average cost of raising it to the surface and delivering it at the machine is 4s. 9d. per ton ; and the average cost of crushing cement and extracting the gold is 3s. 9d. per ton. The average cost of puddling by one party of miners is 1s. 2d. per ton.

The average cost, in one claim, of breaking quartz is 4s. 2½d. per ton ; the average cost of raising it to the surface and delivering it at the machine is 3s. 6d. per ton ; and the average cost of crushing quartz and extracting the gold is 3s. 9d. per ton. The average cost per hour of pumping engines is 2s. 4½d., and of crushing engines is 2s. 3d.

At Maldon, the average cost, in one mine, of raising cement and delivering it at the machine is 1s. 6½d. per ton ; and the cost of crushing and extracting the gold is 2s. per ton. At the Forty-foot Lead, the average cost of raising, carting, and puddling is 6s. 6d. per ton.

The average cost, in two quartz mines, of raising quartz and delivering it at the machine is 27s. 4d. per ton ; and the average cost of crushing quartz and extracting the gold is 14s. 4½d. per ton (stampers and Chilian mills). The average cost per hour of pumping engines is 3s. 6d.

At Ararat, the average cost per hour of pumping, crushing, and winding engines is 5s.

No. 38.

TABLE SHOWING THE NUMBER OF GOLD MINING LEASES ISSUED IN EACH YEAR FOR THE SEVERAL MINING DISTRICTS, FROM 1859 TO 1868 INCLUSIVE.

Mining District.	1859.	1860.	1861.	1862.	1863.	1864.	1865.	1866.	1867.	1868.	Totals.
Ballaarat - -	15	100	49	17	14	25	45	24	17	30	336
Beechworth - -	—	1	5	1	—	24	324	404	52	82	893
Sandhurst - -	3	214	59	24	31	73	133	362	85	59	1,043
Maryborough - -	1	59	24	28	35	100	153	129	68	97	694
Castlemaine - -	3	48	32	19	15	28	44	76	23	31	319
Ararat - -	—	—	9	6	14	20	20	45	33	46	193
Gippsland - -	—	—	—	—	—	—	—	—	55	37	92
Totals -	22	422	178	95	109	270	719	1,040	333	382	3,570

No. 39.

RETURN OF THE NUMBER OF GOLD MINING LEASES IN FORCE ON THE 31ST DECEMBER, 1868,
TOGETHER WITH THE EXTENT OF GROUND LEASED, AND THE PROPOSED CAPITAL TO BE
EMPLOYED IN WORKING THE SAID GROUND.

Mining Districts.	Number of Leases.	Extent.			Total Capital Proposed.
		A.	R.	P.	
Ballaarat - - - - -	63	3,059	2	13	£568,300
Beechworth - - - - -	141	4,719	1	4	855,050
Sandhurst - - - - -	443	2,917	3	2	770,980
Maryborough - - - - -	219	1,964	1	26	470,200
Castlemaine - - - - -	114	1,067	3	36	629,835
Ararat - - - - -	55	693	3	15	111,150
Gippsland - - - - -	69	914	3	12	351,067
Totals - - - - -	1,104	15,337	2	28	£3,756,582

NOTE.—The total number of gold mining leases granted since the commencement is 3,570, containing 61,071a. 3r. 19p. The above table shows those only which were actually in force on the 31st December, 1868.

No. 40.

SUMMARY.—LENGTH OF WATER-RACES CONSTRUCTED, AND THEIR APPROXIMATE COST, IN THE
SEVERAL MINING DISTRICTS, TO DECEMBER, 1868.

Mining Districts.	Length of Races.		Approximate Cost.
	Miles	chains.	
Ballaarat - - - - -	296	38	£31,282
Beechworth - - - - -	1,011	53	216,217
Sandhurst - - - - -	45	30	1,769
Maryborough - - - - -	418	32	11,097
Castlemaine - - - - -	264	27	24,715
Ararat - - - - -	131	60	6,643
Gippsland - - - - -	266	20	18,547
Totals - - - - -	2,434	20	£310,270

No. 41.

TABLE SHOWING THE LENGTH OF WATER-RACES CONSTRUCTED, AND THEIR APPROXIMATE COST, IN THE SEVERAL DIVISIONS AND SUBDIVISIONS OF EACH MINING DISTRICT, TO 31ST DECEMBER, 1868.

Mining Districts, Divisions, and Subdivisions.	Length of Races.	Approximate Cost.
	Miles chains.	£
BALLAARAT—		
Central Division - - - - -	32 40	845
Southern Division - - - - -	2 5	110
Buninyong Division - - - - -	11 0	330
Smythesdale Division - - - - -	11 34	343
Creswick Division - - - - -	108 49	13,535
Gordon Subdivision - - - - -	7 0	180
Steiglitz Subdivision - - - - -	50 0	7,000
Blackwood Division - - - - -	73 70	8,939
Blue Mountain South Subdivision* - - - - -	—	—
Totals - - - - -	296 38	31,282
BEECHWORTH—		
Beechworth Subdivision - - - - -	212 40	65,600
Stanley Subdivision - - - - -	122 20	57,380
Yackandandah Subdivision - - - - -	240 0	43,200
Sandy Creek Subdivision - - - - -	4 3	495
Indigo Division - - - - -	12 0	800
Buckland Division - - - - -	165 60	11,824
Jamieson North Subdivision - - - - -	35 0	6,110
Gaffney's Creek Subdivision - - - - -	39 0	6,864
Wood's Point Subdivision - - - - -	18 30	5,400
Big River Subdivision - - - - -	25 60	3,744
Mitta-Mitta Division - - - - -	120 0	12,000
Jamieson South Subdivision - - - - -	17 0	2,800
Totals - - - - -	1,011 53	216,217
SANDHURST—		
Sandhurst Division - - - - -	16 70	711
Kilmore Division - - - - -	16 40	750
Heathcote Division and Waranga South Subdivision - - - - -	4 0	80
Waranga North Subdivision* - - - - -	—	—
Raywood Division - - - - -	8 0	228
Totals - - - - -	45 30	1,769
MARYBOROUGH—		
Maryborough Division* - - - - -	—	—
Amherst Division - - - - -	390 0	10,000
Avoca Subdivision - - - - -	22 72	687
Dunolly and Tarnagulla Divisions - - - - -	1 40	60
Korong Division* - - - - -	—	—
Redbank and St. Arnaud South Subdivisions* - - - - -	—	—
St. Arnaud North Subdivision - - - - -	4 0	350
Totals - - - - -	418 32	11,097

* None constructed.

No. 41.—TABLE SHOWING THE LENGTH OF WATER-RACES CONSTRUCTED, ETC.—continued.

Mining Districts, Divisions, and Subdivisions.	Length of Races.	Approximate Cost.
	Miles chains.	£
CASTLEMAINE—		
Castlemaine Division* - - - - -	—	—
Fryer's Creek Subdivision - - - - -	15 0	1,500
Hepburn Division - - - - -	230 30	22,080
Taradale Subdivision* - - - - -	—	—
Maldon Division - - - - -	0 57	15
St. Andrew's Division - - - - -	1 0	40
Kyneton Subdivision - - - - -	1 20	50
Blue Mountain North Subdivision - - - - -	16 0	1,030
Totals - - - - -	264 27	24,715
ARARAT—		
Ararat Division - - - - -	4 60	23
Pleasant Creek Division - - - - -	8 40	340
Barkly Division - - - - -	1 40	1,500
Raglan Division - - - - -	117 0	4,780
Totals - - - - -	131 60	6,643
GIPPSLAND—		
Omeo Subdivision - - - - -	93 0	6,290
Mitchell River Subdivision - - - - -	2 40	183
Crooked River Subdivision - - - - -	46 0	1,380
Jericho Subdivision - - - - -	13 10	3,520
Donnelly's Creek Subdivision - - - - -	4 40	1,484
Stringer's Creek Subdivision - - - - -	1 10	450
Russell's Creek Subdivision - - - - -	6 0	240
South Tarraville Subdivision*- - - - -	—	—
Béndoc Subdivision - - - - -	100 0	5,000
Totals - - - - -	266 20	18,547

NOTE.—Several races which have been abandoned owing to the ground being worked out, are not included in the above figures. It will be observed that the cost of construction varies very considerably with the physical character of the country.

* None constructed.

No. 42.

THE NUMBER OF WATER-RIGHT LICENSES FOR GOLD MINING PURPOSES ISSUED FROM THE COMMENCEMENT TO 31ST DECEMBER, 1868, IS AS FOLLOWS:—

Year.	Number.	Area of Races.	Length of Races.	Maximum Quantity of Water to be diverted per diem.	Area of Reservoirs.	Capacity of Reservoirs.	Capital proposed to be invested.	Annual Rent.
		A. R. F.	mis. chns.	gallons.	A. R. F.	gallons.	£	£ s. d.
1863 and 1864	10	236 3 34	51 57	4,923,000	25 2 8	139,349,810	13,575	127 15 0
1865	49	680 1 21	172 43	62,829,300	257 0 37	69,376,000	75,907	288 10 0
1866	38	165 0 2	42 60	56,523,200	15 3 22	19,639,552	36,940	121 5 0
1867	47	151 3 25	44 10	41,121,700	8 2 32	8,586,540	33,485	533 0 0
1868	57	316 2 6	92 24	77,270,260	26 1 21	97,730,000	57,822	422 0 0

No. 43.

Names, Localities, Areas, Storage Capacities, Etc., of Government Reservoirs on the
Goldfields Completed or in Progress, 31st December, 1868.

Name of Reservoir.	Where situated.	Area.	Storage Capacity.	Drainage Area.	Actual or Estimated Cost, exclusive of Inspection, on completion of Reservoir.	Actual or Estimated Cost of Construction, exclusive of Inspection, per Million Gallons.	Average Cost of Earthwork and Puddling, per Cubic Yard.	Maximum Height of Banks.
		A. R. P.	Gallons.	A. R. P.	£ s. d.	£ s. d.	s. d.	Feet.
<i>Reservoirs completed, as follows:—</i>								
Commissioner's Gully	Chewton - -	3 0 28	7,000,000	573 0 0	1,202 16 3	171 17 0	2 1	19'30
Dunolly - -	Dunolly - -	15 2 12	17,200,000	438 0 0	1,912 5 6	111 3 0	5 0½	15'00
Inglewood - -	Old Inglewood -	3 2 20	5,670,000	80 0 0	1,111 12 6	195 18 0	2 3½	19'98
Inglewood - -	New Inglewood -	11 2 28	13,000,000	300 0 0	1,610 0 9	123 17 0	2 2½	13'25
Blackwood - -	Ballan - -	20 2 11	64,441,237	11,078 0 0	1,089 16 8	16 18 0	1 9½	35'00
Quartz Reefs (1) -	Stawell - -	2 2 38	9,725,627	160 0 0	1,080 4 0	111 2 0	1 10½	19'69
Pleasant Creek (3) -	Stawell - -	11 1 29	7,905,750	2,240 0 0	775 3 9	98 2 0	2 10	9'01
Four Posts (9) -	Stawell - -	3 0 32	3,100,000	392 0 0	802 0 0	258 14 2	2 7	11'07
Hepburn - -	Hepburn - -	12 3 0	31,224,413	2,067 0 0	2,526 14 4	80 15 0	2 9½	43'35
Smythesdale - -	Smythesdale -	33 0 0	35,937,000	24,320 0 0	892 4 9	24 17 0	2 0½	12'30
Maryborough - -	Maryborough -	4 3 6	8,100,000	463 0 0	1,065 5 0	131 10 0	1 10½	14'70
Grassy Flat (1) -	Sandhurst -	26 3 2	56,860,375	—	4,002 17 2	70 7 0	2 1½	28'80
Grassy Flat (2) -	Sandhurst -	20 1 30	26,769,369	1,800 0 0	1,754 16 6	65 9 0	1 8½	19'70
Buninyong - -	Buninyong - -	5 0 23	10,462,485	2,080 0 0	1,047 2 6	100 2 0	2 2½	18'16
Creswick - -	Creswick - -	13 0 0	35,392,500	600 0 0	1,077 0 0	30 8 0	2 1½	24'37
Maldon - -	Maldon - -	2 2 3	8,591,504	148 0 0	1,385 15 0	161 3 0	2 8	21'23
St. Arnaud - -	St. Arnaud - -	21 1 0	40,600,000	2,300 0 0	2,903 0 0	71 0 0	—	18'45
Kilmore - -	Kilmore - -	12 0 0	14,466,000	409 0 0	844 13 4	58 7 9	1 6½	25'39
Oliver's Gully - -	Ararat - -	7 0 38	19,615,554	240 0 0	1,730 18 0	88 6 0	2 1	23'74
Amherst - -	Amherst - -	11 1 0	† 13,813,284	2,500 0 0	1,193 7 7	86 9 0	2 4½	12'00
Wedderburn - -	Wedderburn -	3 2 0	3,100,000	500 0 0	992 8 1	320 2 7	2 3½	12'69
Tarnagulla - -	Tarnagulla -	4 0 10	5,000,000	81 0 0	1,167 14 2	233 10 10	1 10½	15'39
Opossum Gully, No. 3	Ararat - -	7 3 0	24,621,547	960 0 0	1,831 6 0	74 8 0	2 1	28'39
Campbell's Reef (6)	Moyston - -	5 0 0	5,400,000	528 0 0	1,054 9 2	195 5 5	2 5	12'03
Beaufort - -	Beaufort - -	38 1 17	85,881,110	1,600 0 0	1,590 14 1	18 10 0	2 5½	16'07
Carngaham - -	Carngaham -	21 0 0	17,151,750	2,714 0 0	750 0 0	43 17 0	2 4	14'60
Yackandandah (1) -	Yackandandah -	4 2 21	14,819,521	—	2,036 13 2	137 11 0	1 11½	39'38
Yackandandah (2) -	Yackandandah -	5 1 5	20,674,450	2,440 0 0	2,394 5 6	115 16 0	1 10	36'47
Lamplough - -	Lamplough - -	6 0 0	9,261,946	379 0 0	1,232 8 3	133 0 0	2 4½	14'00
Sandy Creek - -	Ovens - -	29 2 0	70,000,000	16,000 0 0	2,835 4 0	40 10 0½	2 0	35'15
Redbank - -	Redbank - -	9 3 30	27,100,000	815 1 37	2,785 8 6	102 15 8	2 0½	27'49
Crocodile Gully - -	Fryer's Town -	3 1 0	5,407,462	450 0 0	767 3 0	142 0 0	2 0½	21'66
Spring Gully - -	Fryer's Town -	3 0 16	7,000,000	383 0 0	949 5 6	135 11 0	2 2	22'75
Kincardineshire (3) -	Indigo - -	4 2 28	4,278,937	120 0 0	472 3 4	110 5 0	2 1½	8'52
Durham (2) - -	Indigo - -	4 2 0	8,712,000	60 0 0	475 2 6	54 12 0	2 1	8'43
Suffolk (1) - -	Indigo - -	6 0 0	1,701,562	250 0 0	436 15 11	257 0 0	2 2½	9'90
Pleasant Creek (2) -	Stawell - -	14 0 0	17,000,000	4,800 0 0	—	—	—	12'01
Dinah Flat - -	Forest Creek -	8 0 0	22,842,200	1,190 0 0	640 12 6	28 0 0	1 10½	20'08
<i>Reservoirs in course of construction, viz.:—</i>								
Coliban - -	Malsbury - -	607 0 0	4,500,000,000	64,000 0 0	78,954 12 1	17 10 11	1 9½	56'33
Spring Gully - -	Sandhurst - -	44 0 0	250,000,000	460 0 0	11,965 3 0	47 17 2	1 11½	51
Expedition Pass - -	Forest Creek -	25 2 0	120,000,000	3,600 0 0	16,712 9 11	139 5 5	2 3½	59
Barker's Creek - -	Harcourt - -	127 1 0	500,000,000	3,429 0 0	28,145 3 4	56 5 9	1 9½	49
Stony Creek - -	Brisbane Ranges, near Steiglitz	134 1 24	1,000,000,000	3,181 0 0	42,751 18 0	42 15 0	1 8½	24
Myer's Creek - -	Myer's Flat, near Sandhurst	13 0 0	13,000,000	6,400 0 0	572 9 0	44 0 8	1 6	16

* No information as to cost of earthwork.

† Capacity increased to 76,000,000 gallons, with an area of 46 acres 3 rods.

‡ No information as to cost of works can be obtained.

No. 44.

SUMMARY OF MINING ACCIDENTS WHICH HAVE OCCURRED IN THE COLONY OF VICTORIA DURING THE SIX YEARS BETWEEN 1863 AND 1868, BOTH INCLUSIVE.

Compiled from Inquest Depositions, under the direction of William Henry Archer, Esq., Registrar-General.

Year.	Fall of Earth, Stone, Cement, &c.		Fractures caused by—		Falls.		Injury from Mining Tools.		Cage Accidents.	
	Fractures.	Asphyxia and undefined causes.	Fall of Bucket.	Fall of Windlass, &c.	Into Shaft.	From Bucket, Rope, &c.	Pick.	Jumper, &c.	Decapitation.	Mutilation.
1863	19	35	—	9	13	2	—	—	—	2
1864	28	33	2	5	10	3	—	—	—	2
1865	28	59	—	10	10	6	1	1	—	2
1866	32	46	3	—	24	2	—	1	—	4
1867	17	46	3	4	15	—	—	—	—	4
1868	22	47	1	4	19	3	1	—	—	5
	146	266	9	32	91	16	2	2	—	19

Year.	Blast Accidents.		Suffocation.		Drowning in—		Machinery Accidents.				Total Fatal Mining Accidents of all kinds.
	Scorching.	Mutilation.	Foul Air.	Gallery or Drive Choked.	Sludge.	Water.	Crushing and Puddling.		Tramways.		
							Scalds from Boiler Explosion.	Mutilation.	Jammed.	Run Over.	
1863	—	3	5	5	—	1	—	4	—	—	98
1864	—	2	2	—	—	2	—	1	2	1	93
1865	1	5	4	1	—	2	2	1	—	—	133
1866	1	5	2	—	4	2	4	3	—	—	133
1867	—	4	1	—	—	—	1	4	1	—	100
1868	1	1	3	—	—	—	—	3	—	3	113
	3	20	17	6	4	7	7	16	3	4	670

NOTE.—A Return has been furnished to the Mining Department, showing the date, nature of accident, name of deceased, locality, &c., of each case contained in the above Summary. The particulars are not published here; but attention has been drawn to the fact, that neither *aliases* nor persons described as “unknown” are to be met with in the list, and that in no instance is the cause of the fatal accident ascribed to intoxication.

No. 45.

TABLE SHOWING THE QUANTITIES AND VALUES OF METALS AND MINERALS THE PRODUCE OF THE COLONIES OF VICTORIA, NEW SOUTH WALES, SOUTH AUSTRALIA, QUEENSLAND, AND NEW ZEALAND, AND EXPORTED FROM THE RESPECTIVE COLONIES UP TO 31ST DECEMBER, 1867.

Compiled from Returns furnished by the several Governments.

Metal or Mineral Exported.	VICTORIA. 1851-1867 (17 Years).			NEW SOUTH WALES 1847-1867 (21 Years).		
	Quantity.		Approximate Value.	Quantity.		Approximate Value.
	ozs.	dwt.	£	ozs.	£	
Gold - - - -	35,178,193	15	140,712,775	7,929,688	29,662,825	
Silver - - - -	9,527	17	2,620	tons cwt. gra. lbs.	1,584	
Silver Ore - - -	10	6 0 0	618	7 16 2 5		
Copper - - - -	31	7 0 0	3,511			
Copper Ore - - -	—	—	—	1,595 4 0 0	87,324	
Regulus - - - -	—	—	—			
Iron and Steel - -	—	—	—	735 9 0 0 and 5 casks	4,898	
Iron Sand - - - -	—	—	—	—	—	
Lead - - - - -	—	—	—	—	—	
Lead Ore - - - -	—	—	—	—	—	
Tin - - - - -	5 10 3 12		700	—	—	
Black Sand - - -	2,650 14 0 0		194,345	—	—	
Antimony Ore - -	1,990 19 0 0		21,502	—	—	
Kerosene Shale - -	—	—	—	742 0 0 0	1,565	
Piumbago - - - -	—	—	—	—	—	
Chrome Ore - - -	—	—	—	13 0 0 0	100	
Bismuth - - - -	—	—	—	—	—	
Bismuth Ore - - -	—	—	—	—	—	
Old Metal - - - -	—	—	—	20 7 0 0 and 15 packages	365	
Coal - - - - -	—	—	—	3,568,443 0 0 0	2,516,223	
Total Values - -	—	—	140,936,071	—	32,274,884	

NOTE.—New South Wales.—The gold includes the quantities received at the Mint from other colonies and converted into bars and coin. It is not known what quantities of copper, copper ores, iron, and steel were exported from New South Wales during the years 1847 to 1857 inclusive.

No. 45.—TABLE SHOWING THE QUANTITIES AND VALUES OF METALS AND MINERALS—continued.

Metal or Mineral Exported.	SOUTH AUSTRALIA. 1857-1867 (11 Years).		QUEENSLAND. 1860-1867 (8 Years).		NEW ZEALAND. 1853-1867 (15 Years).	
	Quantity.	Approximate Value.	Quantity.	Approximate Value.	Quantity.	Approximate Value.
	tons cwt.	£	ozs.	£	ozs.	£
Gold - - - -	—	—	128,711	484,970	3,746,214	14,984,856
Silver - - - -	—	—	—	—	—	—
Silver Ore - - -	0 1	10	—	—	—	—
			tons cwt.		tons cwt. qrs.	
Copper - - - -	49,510 7	4,588,983	1,854 6	129,864	—	—
Copper Ore - - -	97,487 0	1,340,109	—	—	2,620 8 0	31,440
Regulus - - - -	1,636 0	71,089	—	—	—	—
Iron and Steel - -	—	—	—	—	—	—
Iron Sand - - -	—	—	—	—	161 13 0	336
Lead - - - -	496 5	28,626	—	—	—	—
Lead Ore - - - -	4,681 0	89,461	—	—	—	—
Tin - - - -	—	—	—	—	—	—
Black Sand - - -	—	—	—	—	—	—
Antimony Ore - -	—	—	—	—	—	—
Kerosene Shale - -	—	—	—	—	—	—
Plumbago - - - -	—	—	—	—	7 0 0	1,400
Chrome Ore - - -	—	—	—	—	5,306 3 2	37,142
Bismuth - - - -	0 4	231	—	—	—	—
Bismuth Ore - - -	19 0	1,830	—	—	—	—
Old Metal - - - -	—	—	—	—	—	—
Coal - - - -	—	—	9,431 0	10,613	1,263 0 0	1,263
Total Values - -	—	6,120,339	—	625,447	—	15,056,437

APPENDIX C.

Bearings of Quartz Reefs.



MINING DISTRICT OF BALLAARAT.

NOTE.—The quartz reefs at Mount Egerton bear N. 12° 20' E., and in places run nearly due north.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Ballaarat and neighborhood—</i>	° ' E.	<i>Wallace and neighborhood—</i>	° ' E.
Prince of Wales - - -	N. 1 10 E.	Fisher's - - -	N. 7 0 E.
Soldier's Hill - - -	N. 3 10 E.	Welshman's - - -	N. 7 0 E.
Township - - -	N. - - -	Little Boy's - - -	N. 7 0 E.
Cemetery - - -	N. 8 50 E.	Kangaroo - - -	N. 7 0 E.
Black Hill - - -	N. 8 0 E.	Patterson's - - -	N. 7 0 E.
Specimen Hill - - -	N. 8 20 E.	Parker's - - -	N. 8 50 E.
Monte Christo - - -	N. 11 20 E.	Barr's - - -	N. 8 50 E.
Band of Hope - - -	N. 7 50 E.	Homeward Bound - - -	N. 8 50 E.
Burra-Burra - - -	N. 1 10 E.	Opossum - - -	N. 6 50 E.
Mount Pleasant - - -	N. 1 10 E.	Union Jack - - -	N. 8 0 E.
		Lone Star - - -	N. 7 30 E.
<i>Between Ballaarat and</i>		Leviathan - - -	N. 7 0 E.
<i>Buninyong—</i>		Morgan's - - -	N. 9 0 E.
Specimen Gully - - -	N. 12 0 E.	Moor's - - -	N. 8 50 E.
Golden Point - - -	N. 8 10 E.	Outward Bound - - -	N. 9 30 E.
Miner's Right - - -	N. 5 0 E.	<i>Near Balla—</i>	
Mount Clear - - -	N. 0 50 E.	Mount Wilson - - -	N. 8 0 E.
Oriental - - -	N. 6 10 E.	<i>Blackwood and neighborhood—</i>	
Fairweather's - - -	N. 7 40 E.	Johnson's - - -	N. 14 20 E.
Long Gully - - -	N. 7 0 E.	Simmons' - - -	N. 17 0 E.
All Nations - - -	N. 9 0 E.	Yankee - - -	N. 15 25 E.
Magpie - - -	N. 8 20 E.	Trehwella's - - -	N. 18 40 E.
Golden Age - - -	N. 8 20 E.	Barry's - - -	N. 18 50 E.
Union Jack - - -	N. 10 10 E.	Union - - -	N. 10 45 E.
Scandinavian - - -	N. 7 40 E.	Bloom's - - -	N. 4 15 W.
Whitehorse - - -	N. 1 40 E.	Lucky-hit - - -	N. 2 15 W.
Hiscock's - - -	N. 4 0 E.	United - - -	N. 12 45 E.
Cemetery - - -	N. - - -	Fern-tree - - -	N. 0 45 E.
Green Hill - - -	N. 3 0 E.	St. George's - - -	N. 8 15 W.
		Eureka - - -	N. 7 45 E.
<i>Between Buninyong and</i>		Homeward Bound - - -	N. 2 15 W.
<i>Hardie's Hill—</i>		All Nations - - -	N. 2 45 E.
Devonshire - - -	N. 8 10 E.	Bald Hill - - -	N. 0 45 E.
Rising Sun - - -	N. 8 40 E.	Butcher's - - -	N. 7 45 E.
Greyhorse - - -	N. 9 40 E.	Wilson's - - -	N. 2 15 W.
Victoria - - -	N. 1 0 W.	Garibaldi - - -	N. 7 45 E.
Glasgow - - -	N. 4 30 E.	<i>Near Mount Bullarook—</i>	
Enfield - - -	N. 8 50 E.	Scandinavian - - -	N. 8 30 E.
Scotchman's - - -	N. 7 20 E.	Victoria - - -	N. 12 20 E.
Albion - - -	N. 7 20 E.	Canadian - - -	N. 6 40 E.

MINING DISTRICT OF BALLAARAT—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Creswick and neighborhood—</i>	° ' "	<i>In the neighborhood of Morrison's Diggings (continued)—</i>	° ' "
Eaglehawk - - -	N. 8 50 E.	Reef unnamed, Mount	
Frenchman's - - -	N. 9 0 E.	Doran Range - - -	N. 9 15 E.
Creswick - - -	N. 8 40 E.	Stony Rises - - -	N. 7 45 E.
Opossum - - -	N. 7 20 E.	Yorkey's - - -	N. 7 45 E.
Spring Hill - - -	N. 7 0 E.		
St. George's - - -	N. 8 20 E.	<i>Steiglitz and neighborhood—</i>	
Slaty Creek - - -	N. 9 40 E.	Homeward Bound - - -	N. 4 50 E.
Sulky Gully - - -	N. 9 20 E.	Chronometer - - -	N. 8 40 E.
<i>In the neighborhood of Carngham, Linton, and Smythesdale—</i>		Kilkenny - - -	N. 19 0 E.
Carngham - - -	N. 8 20 E.	New Year's - - -	N. 13 30 E.
Grassie's - - -	N. 4 11 E.	Dundee - - -	N. 10 0 E.
Brown and Smythe's - - -	N. 8 10 E.	Yankee Smith - - -	N. 2 30 W.
Southern Cross - - -	N. 7 41 E.	Brilliant - - -	N. 11 40 E.
German - - -	N. 7 41 E.	Portuguese - - -	N. 12 20 E.
Victoria - - -	N. 7 41 E.	Vargo's - - -	N. 13 30 E.
Lancashire - - -	N. 7 41 E.	Ballaarat - - -	N. 13 20 E.
Scotchman's - - -	N. 7 41 E.	Victoria - - -	N. 13 25 E.
Independent - - -	N. 7 41 E.	Old German - - -	N. 13 10 E.
Yankee - - -	N. 7 41 E.	Newchum - - -	N. 14 40 E.
Lucky-woman's - - -	N. 12 40 E.	Blackwood - - -	N. 10 10 E.
Britannia - - -	N. 7 36 E.	Daylight - - -	N. 15 30 E.
<i>Between Hardie's Hill and Rokewood—</i>		Moonlight - - -	N. 19 30 E.
Frenchman's - - -	N. 6 20 E.	Scotchman's - - -	N. 12 40 E.
Pinchgut - - -	N. 1 15 W.	Copenhagen - - -	N. 22 30 E.
Penrose - - -	N. 8 25 E.	Boxing - - -	N. 15 40 E.
Staffordshire - - -	N. 2 35 W.	Italian - - -	N. 30 0 W.
<i>In the neighborhood of Morrison's Diggings—</i>		Ironbark - - -	N. 20 0 E.
Little Forest - - -	N. 11 15 W.	German - - -	N. 34 0 E.
Homeward Bound - - -	N. 12 15 W.	Hanover - - -	N. 88 40 W.
Reef unnamed, Walker's		Sailor's - - -	N. 44 0 E.
Range - - -	N. 12 15 W.	Mount Pleasant - - -	N. 35 0 E.
		Prince Alfred - - -	N. 9 45 E.
		Buckingham - - -	N. 10 15 E.
		Balliang - - -	N. 10 25 E.

MINING DISTRICT OF BEECHWORTH.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Chiltern and neighborhood—</i>	° ' "	<i>Near Hillsborough—</i>	° ' "
Higgins' - - -	N. 26 43 W.	Bismarck - - -	N. 32 15 W.
Attrey's - - -	N. 29 13 W.	Eureka - - -	N. 8 45 E.
Mount Hope - - -	N. 16 28 W.	Birthday - - -	N. 19 15 W.
Yankee - - -	N. 32 43 W.	Bon Accord - - -	N. 19 45 E.
Magenta - - -	N. 31 43 W.	Homeward Bound - - -	N. 18 45 E.
Suffolk - - -	N. 11 43 W.	Taff - - -	N. 3 27 W.

MINING DISTRICT OF BEECHWORTH—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>About five miles south of Yackandandah—</i>	° ' 0	<i>South-east borough boundary of Wood's Point—</i>	° ' 0
Comasino - - - -	N. 10 30 E.	Granitoid dykes - -	N. 47 25 W.
<i>Between Stanley and Myrtleford—</i>		<i>Bald Hill on Great Dividing Range—</i>	
Solway - - - -	N. 10 45 E.	Granitoid dykes - -	N. 35 35 W.
Loyal Liberal - - -	N. 10 45 E.		
Nil Desperandum - -	N. 7 45 E.	<i>Between Wood's Point and Jamieson—</i>	
King - - - -	N. 10 45 E.	Castle - - - -	—
Great Britain - - -	N. 12 35 E.	Outward Bound - -	—
Annandale - - - -	N. 10 45 E.	Homeward Bound - -	—
Tubal Cain - - - -	N. 1 15 W.	Dempsey's - - - -	—
<i>Wood's Point and neighborhood—</i>		Cannon's - - - -	—
Waverley - - - -	N. 45 25 W.	Eureka - - - -	—
Never-mind - - - -	{ N. 37 40 W.	Rose of Denmark - -	—
Franklin - - - -	{ N. 39 35 W.	Moonlight - - - -	—
Great Atlantic - - -	N. 43 0 W.	Mountain View - - -	—
Blazing Star - - - -	N. 36 15 W.	Hungarian - - - -	—
Edwards' - - - -	—	Star of the West - -	—
All Nations - - - -	—	Luck's All † - - - -	—
Erin-go-bragh - - -	—	Hayes - - - -	N. 26 14 W.
Garibaldi - - - -	—	Elizabeth - - - -	N. 23 14 W.
Loch Fyne - - - -	—	Lyre-bird - - - -	N. 26 14 W.
Newchum - - - -	—	Wallaby - - - -	N. 26 14 W.
Moonlight - - - -	—	Cornhill - - - -	N. 19 14 W.
Eldorado *- - - -	—	Luck's All (Warner's Creek, Big River) - - - -	N. 16 14 W.
<i>Bald Hill—</i>		The Unknown - - - -	N. 26 14 W.
Volunteer - - - -	N. 37 0 W.	The Seek-and-find - -	N. 26 14 W.
<i>Stander's Creek—</i>		The Reliance - - - -	N. 26 14 W.
Royal Standard - - -	N. 37 30 W.	True Blue - - - -	N. 26 14 W.
Champion - - - -	N. 40 45 W.		
Robert Burns - - - -	N. 39 30 W.	<i>Near Benalla—</i>	
Leviathan - - - -	N. 34 20 W.	Baddaginnie - - - -	N. 22 0 W.
<i>Heads of Raspberry Creek—</i>		<i>Alexandra and neighborhood—</i>	
Granitoid dykes - -	N. 27 20 W.	Luckie - - - -	N. 39 0 W.
<i>West of township of Wood's Point—</i>		Eglinton - - - -	N. 39 0 W.
Granitoid dykes - -	N. 44 30 W.	Eldorado - - - -	N. 41 0 W.
<i>South-east of township of Wood's Point—</i>		Shakespeare - - - -	N. 31 0 W.
Granitoid dykes - -	N. 34 30 W.	United Kingdom - -	N. 29 0 W.
		Robinson Crusoe, or Belle Vue	N. 33 0 W.
		Homeward Bound - -	—
		Mysterious - - - -	—
		Morning Star - - - -	—
		Sunday - - - -	—
		Josephine - - - -	—

* The mining surveyor could only give approximately the general bearing of these reefs—N. 39° to 43° W.

† Strictly speaking these twelve reefs form one continuous line of reef, extending from the head of Raspberry Creek to Mack's Creek, near Jamieson.—The general bearing is from N. 11° 14' to N. 21° 14' W.

MINING DISTRICT OF BEECHWORTH—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Alexandra and neighborhood (continued)—</i>	° ' "	<i>Morse's Creek (continued)—</i>	° ' "
Home - - - -	—	Greenwood - - -	N. 14 15 W.
Little Topsy - - -	—	Well Friendship - - -	N. 19 15 W.
Darling - - - -	—	William Tell - - -	N. 9 15 W.
Pride of the Paps - - -	—	Duke of Northumberland -	N. 11 15 W.
Nil Desperandum - - -	—	Nil Desperandum - - -	N. 17 15 W.
Armstrong - - - -	—	Prince of Wales - - -	N. 31 15 W.
Independent - - - -	—	Slough's - - - -	N. 31 15 W.
Pig and Whistle - - -	—	Hampton - - - -	N. 9 15 W.
Dame Fortune - - - -	—	Eureka - - - -	N. 7 15 W.
Norfolk - - - -	—	Forlorn Hope - - - -	N. 9 15 W.
Strangers - - - -	—	Gladstone - - - -	N. 3 15 E.
Britannia - - - -	—	Berkshire - - - -	N. 24 15 W.
Derby - - - -	—	Oriental - - - -	N. 36 45 W.
Metropolitan - - - -	—		
Durham - - - -	—	<i>Morse's Creek, foot of Oriental Spur—</i>	
Royal Standard - - -	—	McNulty's - - - -	N. 0 45 E.
Duke of Edinburgh - -	—		
Empress Hermion * - -	—	<i>Morse's Creek, south of junction—</i>	
<i>Running Creek—</i>		Bellville - - - -	N. 33 15 W.
Ben. Franklin - - -	N. 25 5 W.	<i>Morse's Creek with Growler's Creek—</i>	
Maidment's - - - -	N. 7 45 W.	McAlpine - - - -	N. 15 45 W.
Root Hog or Die - - -	N. 36 15 W.	Morning Star - - - -	N. 30 45 W.
Annie Laurie - - - -	N. 9 15 W.	Butler's - - - -	N. 34 15 W.
Happy Valley - - - -	N. 30 58 W.	Providence - - - -	N. 4 45 W.
Porepunkah - - - -	N. 8 5 W.	Italians' - - - -	N. 0 15 W.
<i>One-mile Creek—</i>		<i>Growlers' Creek—</i>	
Hearn's - - - -	N. 26 15 W.	Gander's - - - -	N. 19 15 W.
<i>Robert's Creek—</i>		Elgin - - - -	N. 36 45 W.
Heap's - - - -	N. 34 15 W.	Band of Hope - - - -	N. 23 45 W.
<i>Starkie Gully—</i>		John Bull - - - -	N. 29 45 W.
Arthur - - - -	N. 29 15 W.	Scandinavian - - - -	N. 24 15 W.
<i>Morse's Creek—</i>		Mead's - - - -	N. 28 15 W.
Pioneer † - - - -	N. 50 45 E.	Warwick - - - -	N. 19 15 W.
Pioneer cross reef † - -	N. 34 15 W.	Australasia - - - -	N. 36 15 W.
Butler's - - - -	N. 34 15 W.	St. Ives Consols - - -	N. 27 45 W.
Kincaid's - - - -	N. 5 9 E.	Richardson's - - - -	N. 14 15 W.
Ulster - - - -	N. 0 45 E.	Durham - - - -	N. 17 45 W.
Canton - - - -	N. 4 15 W.	Heap's - - - -	N. 15 15 W.
White Star - - - -	N. 0 15 E.	Buck-eye - - - -	N. 24 15 W.
Devonshire - - - -	N. 12 45 W.	Enfield - - - -	N. 11 45 W.
Mount Stewart - - - -	N. 18 45 W.	Ebenezer - - - -	N. 17 55 W.
Durham - - - -	N. 5 45 E.	Perseverance - - - -	N. 0 45 E.
Australia - - - -	N. 9 15 W.	Swipers' - - - -	N. 0 45 E.

* The mining surveyor could only give approximately the general bearings of these reefs—N. 21° to 41° W.

† These reefs intersect.

MINING DISTRICT OF BEECHWORTH—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Growler's Creek, Western Branch—</i>	° ' "	<i>Ovens River, West Branch—</i>	° ' "
Albion - - - -	N. 15 15 W.	Rose of Australia - -	N. 34 15 W.
Helstone - - - -	N. 17 15 W.	Lyre-bird - - - -	N. 34 15 W.
Star of the East - -	N. 51 15 W.	Misery - - - -	N. 22 15 W.
Hope - - - -	N. 15 45 W.	Johnson's - - - -	N. 15 45 W.
Stonewall - - - -	N. 19 15 W.		
Wallaby - - - -	N. 19 15 W.	<i>Ovens River, East Branch—</i>	
Specimen - - - -	N. 7 15 E.	Lion and Unicorn - -	N. 34 45 W.
Golden Bar - - - -	N. 13 15 W.	United Miners - - -	N. 39 50 W.
Home - - - -	N. 13 15 W.	True Blue - - - -	N. 10 15 W.
		Morning Light - - -	N. 12 15 W.
<i>Ovens River, East and South of Bright—</i>			
Lisbon - - - -	N. 9 15 W.	<i>Ovens River, west of Happy Valley Creek—</i>	
Garibaldi - - - -	N. 7 15 W.	Pride of the Ovens - -	N. 12 15 W.
Rose of Australia - -	N. 14 15 W.	London - - - -	N. 11 45 W.
Victoria - - - -	N. 9 15 W.		
Welcome - - - -	N. 10 15 W.	<i>Blanket Creek—</i>	
Three-mile - - - -	N. 25 15 W.	Flower of the Forest -	N. 15 15 W.
Erin-go-Bragh or Falconer's	N. 24 15 W.		
Southern Cross - - -	N. 23 45 W.	<i>Washington Creek—</i>	
Eblana - - - -	N. 20 15 W.	Welcome - - - -	N. 14 15 W.
Harp of Erin - - - -	N. 27 15 W.	Royal Standard - - -	N. 24 15 W.
Sultana - - - -	N. 27 15 W.	Victoria - - - -	N. 27 15 W.
Sons of Freedom - - -	N. 16 15 W.	Bon Accord - - - -	N. 19 15 W.
Reliance - - - -	N. 21 15 W.		
Woolshed - - - -	N. 14 15 W.	<i>Shicer Creek—</i>	
Wombat - - - -	N. 19 15 W.	Perry's - - - -	N. 8 45 W.
Hibernia - - - -	N. 17 45 W.	Good Hope - - - -	N. 40 15 E.
Caledonia - - - -	N. 16 15 W.		
<i>Ovens River, East side of River, opposite Freeburgh—</i>		<i>Clear Creek—</i>	
Kangaroo - - - -	N. 14 15 W.	Red Jacket - - - -	N. 4 15 W.
West Briton - - - -	N. 14 15 W.		
Maggie - - - -	N. 14 15 W.	<i>Buckland River—</i>	
Cornishman's - - - -	N. 13 15 W.	Hibernia - - - -	N. 33 15 W.
<i>Ovens River, Smokeo Creek—</i>		Welcome - - - -	N. 35 45 W.
Lanarkshire - - - -	N. 12 45 W.	Murdoch's - - - -	N. 5 45 E.
Golden Rock - - - -	N. 17 45 W.	Murray's - - - -	N. 28 45 W.
Union - - - -	N. 59 15 W.		
<i>Ovens River, at Hit-or-Miss Creek—</i>		<i>Buckland River, West Branch—</i>	
Newarkhill - - - -	N. 36 15 W.	Nelson - - - -	N. 44 45 W.
Red Parrot - - - -	N. 54 15 W.	Alta - - - -	N. 34 15 W.
Rose, Thistle, and Shamrock - - - -	N. 84 15 W.	Orient - - - -	N. 9 15 W.
Hit-or-Miss - - - -	N. 85 45 W.	Thorp's - - - -	N. 38 15 W.

MINING DISTRICT OF SANDHURST.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Sandhurst and neighborhood—</i>	° ' "	<i>Sandhurst and neighborhood (continued)—</i>	° ' "
Jackass - - - -	N. 16 40 W.	Devonshire - - -	N. 23 28 W.
Prince Alfred - - -	N. 27 30 W.	Eaglehawk - - -	N. 30 28 W.
Victoria - - - -	N. 22 10 W.	Black Forest - - -	N. 7 28 W.
Phillips' - - - -	N. 21 30 W.	Holt's - - - -	N. 7 28 W.
Metropolitan - - -	N. 23 35 W.	Wetherall - - - -	N. 16 28 W.
Hibernian - - - -	N. 38 30 W.	American - - - -	N. 14 28 W.
Railway - - - -	N. 13 10 W.	Deadhorse - - - -	N. 26 28 W.
Brilliant - - - -	N. 10 0 W.	Whitehorse - - -	N. 5 28 W.
Glasgow - - - -	N. 17 0 W.	Star - - - -	N. 4 28 W.
Greenock - - - -	N. 13 10 W.	Deadhorse - - - -	N. 18 28 W.
Sheep's-head - - -	N. 21 58 W.	Clough's - - - -	N. 27 28 W.
Irons - - - -	N. 17 10 W.	St. Mungo's - - -	N. 7 28 W.
Paddy's Gully - - -	N. 9 30 W.	Lightning - - - -	N. 36 28 W.
Hustler's - - - -	N. 40 0 W.	Nelson - - - -	N. 16 28 W.
Redan - - - -	{ N. 28 0 W.	Windmill Hill - -	N. 26 28 W.
Alexander - - - -	{ N. 17 40 W.	Prince of Wales - -	N. 13 28 W.
Belle Vue - - - -	N. 12 56 E.	Catherine - - - -	N. 24 28 W.
British and Foreign -	N. 22 58 W.	Agnew - - - -	N. 14 28 W.
Carshalton - - - -	N. 19 28 W.	Epsom - - - -	N. 7 28 W.
Comet and Eagle - -	N. 21 43 W.	Tyson's - - - -	N. 14 28 W.
Duke of Edinburgh -	N. 1 49 W.		
Duke of Edinburgh -	N. 21 28 W.	<i>Marong—</i>	
Exhibition - - - -	N. 5 3 W.	Duke of Edinburgh -	N. 21 28 W.
Great Eastern - - -	N. 10 43 W.		
New Chum - - - -	N. 12 23 W.	<i>Bullock Creek—</i>	
New Zealand - - - -	N. 22 13 W.	Gifford's - - - -	N. 1 28 W.
Whip - - - -	N. 16 34 W.	Lovie's - - - -	N. 4 32 E.
Wilson - - - -	N. 14 13 W.	Sunday Morning - -	N. 7 28 W.
Simpson's - - - -	N. 30 28 W.		
Britannia - - - -	N. 0 58 W.	<i>Whipstick—</i>	
Burra-Burra - - - -	N. 35 53 W.	Shamrock - - - -	N. 3 28 W.
Christmas - - - -	N. 22 39 W.	Elliot's - - - -	N. 21 28 W.
Derwent - - - -	N. 39 6 W.	Wallace - - - -	N. 1 28 W.
Dunn's and Ramrod -	N. 21 28 W.	Dublin - - - -	N. 11 28 W.
Garden Gully - - -	N. 27 28 W.	Frühling - - - -	N. 6 28 W.
Monument Hill - - -	N. 22 46 W.		
Napoleon and Wellington -	N. 24 38 W.	<i>Neilborough—</i>	
Perfect Cure - - - -	N. 11 28 W.	Barkly - - - -	N. 4 32 E.
Wallaby and Makosk -	N. 31 28 W.		
Prince Charlie - - -	N. 19 58 W.	<i>Raywood—</i>	
Albion - - - -	N. 28 39 W.	Welbourne - - - -	N. 11 28 W.
Bignell's - - - -	N. 19 28 W.	Coulter's - - - -	N. 11 28 W.
Johnson's - - - -	N. 26 28 W.	May - - - -	N. 8 28 W.
Shellback - - - -	N. 7 28 W.	Christmas - - - -	N. 11 28 W.
Robert Burns - - -	N. 12 28 W.		
Comet - - - -	N. 8 28 W.	<i>Kamarooka—</i>	
Leicester - - - -	N. 15 28 W.	Jones' - - - -	N. 3 28 W.
Clarence - - - -	N. 19 28 W.	Doubtful - - - -	N. 5 28 W.
Sebastopol - - - -	N. 18 28 W.	Pembroke Castle - -	N. 3 28 W.
Anglo - - - -	N. 11 28 W.		
Specimen Hill - - -	N. 15 28 W.		

MINING DISTRICT OF SANDHURST—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Rushworth and neighborhood—</i>	° ' "	<i>Redcastle—</i>	° ' "
Nuggety - - - -	N. 83 15 W.	Leviathan - - - -	N. 18 17 W.
Mongolian - - - -	N. 89 15 W.	Leslie's - - - -	N. 18 17 W.
South Devon - - - -	N. 83 15 W.	Mary Anne - - - -	N. 18 17 W.
Frenchman's - - - -	N. 89 15 W.	Welcome - - - -	N. 31 0 W.
Eclipse - - - -	N. 89 15 W.	Sawyer's Blow - - - -	N. 68 35 W.
Main Gully - - - -	N. 89 15 W.	Beautiful Venice - - - -	N. 18 50 E.
Scrub - - - -	N. 84 15 W.	Abandoned - - - -	N. 1 0 E.
South Nuggety - - - -	W.	<i>Heathcote—</i>	
Perseverance - - - -	N. 84 15 W.	Golden Gully - - - -	N. 72 0 W.
Ahern's - - - -	N. 87 45 E.	Alfred - - - -	N. 64 54 W.
Monsey's - - - -	N. 87 45 E.	Kirkham's - - - -	N. 43 0 W.
Charcoal - - - -	N. 86 45 E.	Long Gully - - - -	N. 29 30 E.
Belfast - - - -	N. 82 45 E.	Argyle Gully - - - -	N. 25 30 E.
Growler's - - - -	N. 0 45 E.	Alabama - - - -	N. 30 0 W.
<i>Whroo and neighborhood—</i>		Scandinavian - - - -	N. 51 3 W.
Victoria - - - -	N. 84 15 W.	Butler's - - - -	N. 57 30 W.
Carr's - - - -	N. 84 15 W.	Caledonia - - - -	N. 29 30 E.
Johnson's - - - -	N. 84 15 W.	<i>Tooborac—</i>	
Albert - - - -	N. 84 15 W.	Redan - - - -	N. 11 50 W.
Prince of Wales - - - -	N. 83 15 W.	Mariner's - - - -	N. 11 53 W.
Happy-go-Lucky - - - -	N. 88 45 E.	Native Perseverance - - - -	N. 12 0 W.
King David - - - -	N. 86 45 E.	<i>Costerfield—</i>	
Stockyard - - - -	N. 67 45 E.	Bombay - - - -	N. 0 40 W.
Malakhoff - - - -	N. 29 15 W.	Minerva - - - -	N. 0 45 W.
Balaclava - - - -	N. 20 30 W.	Costerfield Company's - - - -	N. 0 45 W.
<i>Coy's Diggings—</i>		<i>Five and a-half miles west from</i>	
Coy's - - - -	N. 89 15 W.	<i>Kilmore—</i>	
Hit-or-Miss - - - -	N. 75 45 E.	Unnamed - - - -	N. 12 0 W.
Morning Star - - - -	N. 36 15 W.	<i>Yea—</i>	
Guernsey - - - -	N. 34 15 W.	Providence - - - -	N. 37 20 W.
Welcome - - - -	N. 23 15 W.	Carriers' - - - -	N. 48 40 W.
Hick's - - - -	N. 21 15 W.	<i>About eight miles west of Yea—</i>	
Byron - - - -	N. 15 15 W.	Brown's - - - -	N. 6 40 E.
Murray - - - -	N. 6 45 E.	Whittaker's - - - -	N. 36 50 E.
London - - - -	N. 6 45 E.	German - - - -	N. 9 20 E.
Blackwall - - - -	N. 6 45 E.	Murchison's - - - -	N. 37 0 W.

MINING DISTRICT OF MARYBOROUGH.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Between Maryborough and Timor—</i>	° ' "	<i>Between Maryborough and Timor (continued)—</i>	° ' "
Bristol - - - -	N. 8 0 E.	Harper's - - - -	N. 15 0 E.
Griffiths' - - - -	N. 79 40 W.	Clydeside - - - -	N. 21 40 W.
Telegraph - - - -	N. 17 30 W.	Arento - - - -	N. 22 25 W.
Leviathan - - - -	N. 10 38 W.	Lucknow - - - -	N. 2 25 W.
Victoria - - - -	N. 10 38 W.	Britons - - - -	N. 7 0 W.

MINING DISTRICT OF MARYBOROUGH—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Between Maryborough and Amherst, and in the neighborhood of Amherst—</i>	° ' "	<i>Moonambel—</i>	° ' "
Flagstaff - - - -	N. 35 30 W.	Slaughteryard - - -	N. 5 10 W.
Shicer - - - -	N. 35 30 W.	<i>Redbank and neighborhood—</i>	
Specimen - - - -	N. 5 30 E.	Mount View - - - -	N. 39 0 E.
Liberty - - - -	N. 5 30 E.	Victoria - - - -	N. 14 30 W.
Mosquito - - - -	N. 10 0 W.	Pyrenees - - - -	N. 23 30 W.
Prince of Wales - -	N. 9 6 W.	Hope - - - -	N. 21 30 W.
Prince Frederick William -	N. 13 40 E.	Raphoe - - - -	N. 25 0 W.
Princess Royal - - -	N. 9 30 E.	Richmond - - - -	N. 24 40 W.
Mariner's - - - -	N. 12 0 W.	Apennines - - - -	N. 49 30 E.
North British - - -	N. 9 54 E.	Gloucester - - - -	N. 33 0 W.
Welshman's - - - -	N. 14 30 W.	Kent - - - -	N. 32 40 W.
Dane - - - -	N. 4 6 W.	Caledonian - - - -	N. 35 0 W.
Churchill - - - -	N. 4 54 E.	Jenny Lind - - - -	N. 38 0 W.
Picaninny - - - -	N. 6 0 W.	May - - - -	N. 36 40 W.
Portuguese - - - -	N. 5 45 W.	Derby - - - -	N. 36 30 W.
Whitehorse - - - -	N. 9 54 E.	Haggie's - - - -	N. 18 0 W.
Hospital - - - -	—		
Pale Brandy - - - -	N. 8 40 E.	<i>Between St. Arnaud and</i>	
Frenchman's - - - -	N. 20 30 E.	<i>Stuart Mill—</i>	
Britannia - - - -	N. 16 0 E.	Jerejaw - - - -	N. 20 40 W.
Sydney - - - -	N. 25 30 E.	Fishhook - - - -	N. 47 10 W.
Blucher's - - - -	N. 2 6 W.	Greenock - - - -	N. 44 17 W.
		With a cross reef - -	N. 12 10 W.
<i>Talbot and neighborhood—</i>		Spinster's - - - -	N. 36 55 W.
Mount Glasgow - - -	N. 40 40 E.	<i>Stuart Mill—</i>	
Cornubian - - - -	N. 42 30 E.	Star of the East - - -	N. 35 55 W.
Christmas - - - -	N. 2 24 E.	Macoboy - - - -	N. 35 10 W.
New Year's - - - -	N. 36 0 E.	Oxonian - - - -	N. 38 10 W.
Sydenham - - - -	N. 33 20 E.	Eureka - - - -	N. 9 10 W.
Mornington - - - -	N. 6 6 W.		
Canadian - - - -	N. 35 0 E.	<i>About eight miles east of</i>	
Mia-Mia - - - -	N. 26 0 E.	<i>Strathfillan—</i>	
Amsterdam - - - -	N. 22 0 E.	Isabelle - - - -	N. 20 10 W.
Elgin - - - -	N. 27 30 E.	Emu - - - -	N. 7 10 W.
Staffordshire - - -	N. 26 0 E.		
Goodwoman's - - - -	N. 6 34 E.	<i>Between Dunolly and Mount</i>	
Nuggety - - - -	N. 6 34 E.	<i>Moliagul—</i>	
All Nations - - - -	N. 6 34 E.	Perseverance - - - -	N. 2 40 W.
Hit-or-Miss - - - -	N. 21 0 E.	Patterson's - - - -	N. 4 0 E.
Finche's - - - -	N. 20 10 E.	Old Lead - - - -	N. 11 20 W.
		Pioneer - - - -	N. 4 30 E.
<i>Near Majorca—</i>		Bealiba - - - -	N. 5 40 W.
Prussian - - - -	N. 3 6 W.	Exhibition - - - -	N. 20 40 W.
Welcome - - - -	N. 3 6 W.	Annandale - - - -	N. 5 35 W.
Pinche's - - - -	N. 2 24 E.	Arcadian - - - -	N. 2 0 W.
Greenway's - - - -	N. 2 24 E.	Christmas - - - -	N. 1 30 E.
		Queen's - - - -	N. 2 50 E.
<i>Between Moonambel and Avoca—</i>		Sheoak - - - -	N. 1 40 E.
Magenta - - - -	N. 3 50 E.	Lone Star - - - -	N. 11 20 W.

MINING DISTRICT OF MARYBOROUGH—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Between Dunolly and Mount Moliagul (continued)—</i>	°	<i>Tarnagulla and Llannelly (continued)—</i>	°
German - - - -	N. 5 20 W.	Watt's - - - -	N. 1 50 W.
Belgian - - - -	N. 9 20 W.	Last Chance - - - -	N. 1 20 W.
Catherine - - - -	N. 3 20 W.	Hard-up - - - -	N. 1 10 E.
Pensum's - - - -	—	Newchum - - - -	N. 1 50 W.
Harvest Home - - - -	—	Forlorn Hope - - - -	N. 8 0 W.
Bismarck - - - -	—	Maiden - - - -	N. 1 0 W.
		British and American - - - -	N. 3 20 W.
<i>Moliagul and neighborhood—</i>		Antrim - - - -	N. 3 20 W.
Nuggety Point - - - -	—	Sandstone - - - -	N. 6 20 W.
Jones' - - - -	—	Stubbs' - - - -	N. 3 40 E.
German - - - -	—	Nuggety - - - -	N. 3 20 W.
Slaty - - - -	—	Canadian - - - -	—
Slaughter Hill - - - -	—	Baker's - - - -	—
Wayman's - - - -	—	Irvine's - - - -	—
Hogarth's - - - -	—	Needful - - - -	—
Black - - - -	—	Greek - - - -	—
Bull-dog * - - - -	—	Havelock - - - -	—
Stewart's Hill - - - -	N. 3 20 W.	Poverty - - - -	—
		Jim Crow - - - -	—
<i>Dunolly—</i>		Victoria - - - -	—
Monday Morning - - - -	—	Stony - - - -	—
Lancashire - - - -	—	Phantom - - - -	—
Experimental - - - -	—	Tarnagulla - - - -	—
Slaughter Hill * - - - -	—	Montebello - - - -	—
St. Marys - - - -	N. 6 20 W.	Hellas * - - - -	—
Arvan - - - -	N. 86 40 E.		
<i>Between Dunolly and Bet-bet—</i>		<i>Cay's Diggings—</i>	
Quaker's - - - -	N. 8 20 W.	Kangaroo - - - -	N. 9 20 W.
Murphy's - - - -	—	Try-me-well - - - -	N. 12 20 W.
Consolation - - - -	—	Specimen - - - -	N. 12 20 W.
Cheshire - - - -	—	American * - - - -	—
Bet-Bet - - - -	—		
Garibaldi - - - -	—	<i>Between Kingower and Kooyooro—</i>	
Windmill * - - - -	—	Union - - - -	N. 14 10 E.
Walker's - - - -	N. 16 20 W.	Walker's - - - -	N. 4 10 E.
Canton - - - -	N. 16 20 W.	Bon Accord - - - -	N. 5 10 E.
Glasgow - - - -	N. 11 20 W.	Hope - - - -	N. 0 40 E.
Cox's - - - -	N. 11 20 W.		
<i>Tarnagulla and Llannelly—</i>		<i>At Jericho and Jordan Diggings, about eight miles west of Kooyooro—</i>	
Mother Chisholm's - - - -	N. 4 10 W.	Milkman's - - - -	—
Woolshed - - - -	N. 9 30 E.	Patterson's - - - -	—
Great Western - - - -	N. 2 30 E.	Black - - - -	—
Sabbath - - - -	N. 0 30 E.	Phillip's - - - -	—
Specimen - - - -	N. 5 30 E.	Adelaide - - - -	—
Doubtful - - - -	N. 11 10 W.	Frenchman's - - - -	—
Corfu - - - -	N. 4 10 E.	German * - - - -	—
Star - - - -	N. 3 20 W.		

* The mining surveyor could not give the bearings of these reefs.

MINING DISTRICT OF MARYBOROUGH—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Inglewood and neighborhood—</i>	° /	<i>Wedderburn and neighborhood</i>	° /
American - - - -	N. 8 ° E.	(continued)—	
Caledonian - - - -	N. 10 40 E.	Lincoln - - - -	N. 1 30 E.
Galloway - - - -	N. 13 ° E.	Solway - - - -	N. 0 30 E.
Nairnshire - - - -	N. 6 ° E.	Sunday Morning - - -	—
Cosmopolitan - - -	N. 8 ° E.		
Annandale - - - -	N. 5 30 E.	<i>St. Arnaud and neighborhood—</i>	
Daly's - - - -	N. 3 ° E.	Jones' - - - -	—
Manchester - - - -	N. 14 ° E.	Oakley's * - - - -	—
Blucher's - - - -	N. 5 ° E.	Lock's - - - -	N. 27 ° W.
Jamaica - - - -	N. 7 30 E.	Sebastopol - - - -	N. 34 30 W.
Norfolk - - - -	N. 7 25 E.	Edward's - - - -	N. 31 30 W.
Fifeshire - - - -	N. 4 30 E.	Wilson's - - - -	N. 37 20 W.
Union Jack - - - -	N. 2 ° W.	Bristol - - - -	N. 33 30 W.
Schule's - - - -	—	Clark's - - - -	N. 42 30 W.
March - - - -	—	Blink Bonnie - - - -	N. 36 40 W.
Maxwell's - - - -	—	Bell Rock (with a cross reef)	{ N. 89 36 E.
Columbian - - - -	—		{ N. 27 10 W.
Jersey - - - -	—	Pinnacle (with a cross reef)	{ S. 85 47 E.
European - - - -	—		{ N. 67 50 E.
Welcome - - - -	—	Malakoff (with a cross reef)	{ N. 82 50 E.
Marshall's * - - -	—		{ N. 67 10 W.
<i>Wedderburn and neighborhood—</i>		Hopeful - - - -	N. 36 10 W.
Black - - - -	N. 11 30 E.	Gap - - - -	N. 35 10 W.
Lane's - - - -	N. 12 30 E.	Armenian - - - -	N. 32 10 W.
Specimen - - - -	N. 13 ° E.	Warwickshire - - -	N. 27 10 W.
Garibaldi - - - -	N. 11 30 E.	Ballaarat - - - -	N. 27 10 W.
		Western - - - -	N. 7 50 W.

* The mining surveyor could not give the bearings of these reefs.

MINING DISTRICT OF CASTLEMAINE.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Castlemaine and neighborhood—</i>	° /	<i>Castlemaine and neighborhood</i>	° /
Lucknow - - - -	N. 6 41 E.	(continued)—	
Diamond - - - -	N. 7 ° W.	South American - - -	N. 1 49 W.
Nimrod - - - -	N. 7 19 W.	German Gully - - -	N. 14 30 W.
Big Hill - - - -	N. 13 ° W.	Trewartha's - - - -	N. 13 40 W.
Black Monday - - -	N. 9 30 W.	Bickford's - - - -	N. 10 30 W.
Burns' - - - -	N. 4 ° E.	Englishman's - - - -	N. 3 ° W.
Welcome - - - -	N. 4 ° E.	Little Quartz Hill - -	N. 4 30 W.
Cemetery - - - -	N. 12 45 W.	Golden Gully - - - -	N. 5 10 W.
Specimen - - - -	N. 3 30 W.	Leicestershire - - -	N. 9 20 W.
Argus - - - -	N. 12 41 W.	Old Quartz Hill - - -	N. 6 19 W.
Manchester - - - -	N. 6 56 E.	Cemetery - - - -	N. 4 30 W.
Sheep's-head - - -	N. 3 20 W.	Dog-leg - - - -	N. 12 30 W.
Victoria or Walker's -	N. 3 41 E.	Fiddler's or Crawford's -	N. 8 41 E.
Dead-cat - - - -	N. 9 34 W.	Shicer or Cadzow - - -	N. 2 45 W.

MINING DISTRICT OF CASTLEMAINE—*continued.*

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Castlemaine and neighborhood (continued)—</i>	° ' "	<i>Castlemaine and neighborhood (continued)—</i>	° ' "
Sebastopol - - -	N. 2 41 E.	Capper's No. 2 - - -	N. 13 30 W.
Magenta - - -	N. 11 30 W.	Black's - - -	N. 7 0 E.
Post Office - - -	N. 1 19 W.	Hermitage - - -	N. 13 30 W.
Hard Hill - - -	N. 1 11 E.	Northumberland - - -	N. 13 25 W.
Constitution - - -	N. 8 0 W.	Specimen - - -	N.
Whitehorse - - -	N. 7 19 W.	Fortune - - -	N. 2 0 W.
Crocodile - - -	N. 12 0 W.	Napier - - -	N. 4 0 E.
Red Hill - - -	N. 13 0 W.	Tonga's - - -	N. 5 30 W.
Chewton - - -	N. 13 41 E.	Tonga's No. 2 - - -	N. 1 0 W.
Shank's - - -	N. 10 41 E.	Granite - - -	N. 22 15 W.
Upper Wattle Gully - - -	N. 2 30 W.	Launceston - - -	N. 4 0 E.
Old Wattle Gully - - -	N. 3 41 E.	Hennick's - - -	N. 14 0 W.
Phillip's - - -	N. 6 11 E.	Mosquito - - -	N. 6 0 W.
Sandstone - - -	N. 18 41 E.	Cranky Ned's - - -	N.
Prior's - - -	N.	Gordon's - - -	N. 3 10 W.
Callander's - - -	N. 1 19 W.	Turnbull's - - -	N. 2 30 W.
Deadman's - - -	N. 5 30 W.	London - - -	N.
Mona - - -	N. 12 0 W.	Clinker's Hill - - -	N.
Monk's Hill - - -	N. 8 0 W.	South American - - -	N. 8 0 W.
Eureka North - - -	N. 6 11 E.		
Eureka South - - -	N. 0 41 E.	<i>Taradale, Malmsbury, and neighborhood—</i>	
Vineyard - - -	N. 11 41 E.	Achilles - - -	N. 2 15 E.
Steel's or Log - - -	N. 3 0 W.	Alpha - - -	N. 2 15 E.
Champion - - -	N. 8 30 W.	Victoria - - -	N. 6 15 W.
Meredith or Little Bendigo - - -	N.	Prince Albert - - -	N. 6 39 W.
Welcome - - -	N. 5 30 W.	Barfold - - -	N. 0 15 W.
Lady Sutton - - -	N. 5 0 W.	Burra-Burra - - -	N. 6 55 W.
Royal - - -	N. 8 0 W.	Humboldt - - -	N. 12 15 W.
Kamph's - - -	N. 6 0 W.	Hanover - - -	N. 10 15 W.
Victoria - - -	N. 7 30 W.	Belltopper - - -	N. 12 15 W.
Town or Commercial - - -	N. 8 41 E.	Frenchman's - - -	N. 12 15 W.
Devonshire - - -	N. 4 11 E.	Kangaroo - - -	N. 9 45 W.
Moonlight - - -	N. 3 30 W.	Wyndham - - -	N. 2 15 E.
British American - - -	N. 6 30 W.	Coliban - - -	N. 1 30 E.
Tarr's - - -	N. 9 30 W.	Comet - - -	N. 13 55 W.
Surveyor's - - -	N. 2 10 W.		
Adelaide Hill - - -	N. 4 0 W.	<i>Fryerstown and neighborhood—</i>	
Bolivia - - -	N. 8 41 E.	Cemetery - - -	N. 12 40 E.
East Bolivia - - -	N. 8 0 W.	Bullock - - -	N. 0 40 E.
Cumberland - - -	N. 11 41 E.	Ferron's - - -	N. 5 30 E.
Poverty - - -	N. 11 41 E.	Heron's - - -	N. 5 40 E.
White Hill - - -	N. 3 0 W.	Clarke's - - -	N. 5 40 E.
Dutchman's - - -	N. 10 0 W.	Castle's - - -	N. 1 35 W.
Nuggety - - -	N. 11 41 E.	Town - - -	N. 6 10 E.
Little Nuggety - - -	N. 9 0 W.	Greenwood - - -	N. 0 50 W.
Skeen's - - -	N. 1 0 W.	Eldorado - - -	N. 9 10 E.
Nicholson's - - -	N. 5 0 W.	Emu - - -	N. 2 10 W.
Lady Barkly - - -	N. 2 0 W.	Bristol - - -	N. 9 10 E.
German Banner - - -	N. 4 41 E.	German Gully - - -	N. 9 20 W.
Capper's - - -	N. 9 20 W.		

MINING DISTRICT OF CASTLEMAINE—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef	Bearing from True Meridian.
<i>Fryerstown and neighborhood</i> (continued)—	° ' "	<i>Near Yandoit Hill—</i>	° ' "
Norfolk - - - -	N. 8 50 E.	Clement's New - - -	N. 1 35 E.
Frenchman's - - -	N. 9 5 W.	Cosmopolitan - - -	N. 1 35 E.
Chapel Hill - - -	N. 11 34 W.	Boundary - - - -	N. 1 35 E.
Shakespeare - - -	N. 8 10 E.	Bertha - - - -	N. 1 35 E.
Prince of Wales - -	N. 0 50 W.	Canadian - - - -	N. 8 45 E.
Collier's - - - -	N. 4 40 E.	Sardine or Garibaldi -	N. 1 55 W.
Hit-or-Miss - - -	N. 0 23 W.	Pioneer - - - -	N. 7 5 E.
		Great - - - -	N. 2 52 E.
<i>Maldon and neighborhood—</i>		Homeward Bound - -	N. 14 12 W.
Manton's - - - -	{ N. 10 45 E.	Christmas - - - -	N. 6 5 W.
	{ N. 23 0 W.	Morning Light - - -	N. 6 55 W.
Cookman's - - - -	N. 8 30 W.	All Nations - - - -	N. 1 35 E.
Beehive - - - -	{ N. 13 15 W.		
	{ N. 28 0 W.	<i>Daylesford and neighborhood—</i>	
Linscott's - - - -	N. 18 55 W.	St. George's - - - -	N. 2 25 W.
Mosquito - - - -	N. 8 45 E.	Wombat - - - -	N. 1 0 E.
Fenteman's - - - -	N. 20 0 W.	Adam's - - - -	N. 3 5 E.
Smith's - - - -	{ N. 12 5 W.	Melvin's - - - -	N. 4 5 E.
	{ N. 40 30 W.	Argus - - - -	N. 6 35 W.
Welshman's - - - -	N. 40 45 W.	Wonderful - - - -	N. 7 55 W.
Dunn's - - - -	N. 40 45 W.	Mitchell's or Cameron's	N. 4 35 W.
Red, White, and Blue	N. 8 41 E.	Pitcher's - - - -	N. 10 15 W.
Town - - - -	N. 1 54 W.	Nil Desperandum - -	N. 0 5 E.
Victoria - - - -	N. 4 21 W.	Iveson's - - - -	N. 1 55 W.
German - - - -	N. 8 47 W.	Crown - - - -	N. 6 35 W.
Parkins' - - - -	N. 6 54 W.	Collier's - - - -	N. 7 35 W.
Purcell's - - - -	N. 5 51 E.	Gazely - - - -	N. 2 11 W.
Braithwaite's - - -	N. 13 21 W.	Encore - - - -	N. 2 11 W.
Friendship - - - -	N. 5 9 W.	Richardson's - - -	N. 6 35 W.
North of England - -	N. 2 12 W.	Mauritius - - - -	N. 9 15 W.
Bell's - - - -	N. 6 44 W.	Commissioner's - - -	N. 3 5 E.
Mariner's - - - -	N. 4 9 W.	Parker's Specimen - -	N. 6 37 W.
Tiverton - - - -	N. 1 30 E.	Scandinavian - - -	N. 5 25 E.
Brewer's - - - -	N. 5 24 W.	Adelaide - - - -	N. 8 5 E.
Lisle's - - - -	N. 8 6 E.	Specimen - - - -	N. 16 15 W.
Lahn's - - - -	N. 1 54 W.		
Eaglehawk - - - -	N. 6 54 W.	<i>Near Sunbury—</i>	
Cumberland - - - -	N. 2 12 W.	Beattie's - - - -	N. 58 30 E.
Nuggety - - - -	N. 7 36 W.		
<i>Between Maldon and</i>		<i>Near the junction of Donovan's</i>	
<i>Newstead—</i>		<i>Creek with the River Yarra</i>	
Concord - - - -	N. 3 54 W.	Yarra—	
Christmas - - - -	N. 3 54 W.	Star - - - -	N. 11 5 W.
Wilson's - - - -	N. 11 24 W.	Golden Bower - - -	N. 11 5 W.
Otago - - - -	N. 5 54 W.	Great Britain - - -	N. 12 40 E.
Omega - - - -	N. 3 54 W.	Sarah Jane - - - -	N. 4 20 W.
Excelsior - - - -	N. 3 54 W.		
John Bull - - - -	N. 3 54 W.	<i>Near the junction of Alder-</i>	
Thornhill's - - - -	N. 0 6 E.	<i>man's Creek with the River</i>	
		<i>Yarra Yarra—</i>	
		Christmas - - - -	N. 13 30 W.

MINING DISTRICT OF CASTLEMAINE—continued.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Queenstown and neighborhood—</i>	° ' "		° ' "
Comet - - - -	N. 5 28 E.	<i>Near Warringall—*</i> - -	N. 11 40 E.
Pioneer - - - -	N. 11 57 E.		
Hawkins' - - - -	N. 24 40 E.	<i>Near Frankston—*</i> - -	N. 11 30 E.
Allen's - - - -	N. 20 10 E.		
Victoria - - - -	N. 21 15 E.	<i>Near Dromana—</i>	
Moonlight - - - -	N. 44 6 E.	Brown's - - - -	N. 14 30 E.
Queenstown - - - -	N. 35 20 W.		
Cornish - - - -	N. 41 20 E.	<i>Blue Mountains—</i>	
Boomer's - - - -	N. 32 40 E.	Alma - - - -	N. 4 22 E.
Oram's - - - -	N. 26 10 E.	Amelia - - - -	N. 6 45 E.
Eureka - - - -	N. 12 40 E.		
Fourth Hill - - - -	N. 10 50 W.		

* The mining surveyor could not give the names of these reefs.

MINING DISTRICT OF ARARAT.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Ararat and neighborhood—</i>	° ' "		° ' "
Kangaroo - - - -	N. 15 40 W.	<i>Near Landsborough—</i>	
Eaglehawk - - - -	N. 19 40 W.	Frenchman's - - - -	N. 22 22 W.
Moor's - - - -	N. 17 10 W.	Power's - - - -	N. 32 22 W.
<i>The Reefs Township—</i>		<i>About eight miles east of Stawell—</i>	
Bonnie Dundee - - - -	N. 2 22 W.	Joel-Joel - - - -	N. 22 22 W.
Flying Doe - - - -	N. 2 22 W.		
Durham - - - -	N. 42 22 W.	<i>Moyston—</i>	
Manners Sutton - - - -	N. 42 22 W.	Campbell's - - - -	N. 19 0 W.
Clifton - - - -	N. 42 22 W.		
Wonga-Wonga - - - -	N. 57 22 W.	<i>Near Malakhoff—</i>	
Moonlight - - - -	N. 38 22 W.	Glendhu - - - -	N. 32 22 W.
Cross - - - -	N. 42 22 W.		
Nuggety - - - -	N. 37 22 W.	<i>Great Western—</i>	
Cosmopolitan - - - -	N. 32 22 W.	Jonathan's - - - -	N. 42 22 W.
<i>About two miles N.E. of Stawell—</i>			
Newchum - - - -	N. 20 0 W.	<i>About five and a-half miles N.E. of Beaufort—</i>	
Mariner's - - - -	N. 19 0 W.	The Sheet Anchor - - - -	N. 9 26 W.
Scotchman's - - - -	N. 38 30 W.		
Perthshire - - - -	N. 50 0 W.	<i>About one mile north of Beau-</i>	
Hampshire - - - -	N. 50 0 W.	fort—	
Birmingham - - - -	N. 29 0 W.	The Red Hill - - - -	N. 42 34 E.
	N. 5 20 E.		
	N. 18 0 W.		

MINING DISTRICT OF GIPPSLAND.

Locality and Name of Reef.	Bearing from True Meridian.	Locality and Name of Reef.	Bearing from True Meridian.
<i>Grant and neighborhood—</i>	°	<i>Near the junction of Stringer's Creek and the Thomson River—</i>	°
Armenian - - -	N. 53 10 W.	Perseverance - - -	N. 0 30 E.
Jolly Sailors - - -	N. 54 30 W.	Shamrock - - -	N. 0 30 E.
Bird-in-Hand - - -	N. 80 46 W.	Scrat-a-bit - - -	N. 0 30 E.
Wingate - - -	N. 50 0 W.	Tubal-Cain - - -	N. 0 30 E.
Victoria - - -	N. 58 16 W.	Longfellow's - - -	N. 0 30 E.
Time-will-Tell - - -	N. 55 46 W.	Cohen's - - -	N. 0 30 E.
Eureka - - -	N. 20 46 W.	Eureka - - -	N. 0 30 E.
Valleymount - - -	N. 63 0 W.	Happy-go-Lucky - - -	N. 0 30 E.
Excelsior - - -	N. 47 40 W.		
Palmerston - - -	N. 56 10 W.		
Avlan - - -	N. 68 10 W.		
Catherine - - -	N. 54 0 W.		
Pioneer - - -	N. 50 46 W.		
Eglinton - - -	N. 56 30 W.		
Columbia - - -	N. 61 0 W.		
Rose and Shamrock - - -	N. 12 30 W.		
Uncle Tom - - -	N. 62 30 W.		
McLean's - - -	N. 50 46 W.		
Good Hope - - -	N. 62 0 W.		
Good Luck - - -	N. 21 20 W.		
Britannia - - -	N. 60 46 W.		
Beautiful Star - - -	N. 62 0 W.		
Mountaineer - - -	N. 65 10 W.		
Rose of Denmark - - -	N. 56 26 W.		
Luck's All - - -	N. 76 20 W.		
Jeff. Davis - - -	{ N. 47 40 E.		
	{ N. 57 0 W.		
		<i>In the basin of the Bendoc and Delegete Rivers—</i>	
		Britannia - - -	—
		United - - -	—
		Morning Star - - -	—
		Come Love - - -	—
		Imperial - - -	—
		Homeward Bound - - -	—
		Primrose - - -	—
		Rising Sun - - -	—
		Binang* - - -	—

* These reefs run nearly due north.



APPENDIX D.

Regulations relating to Gold and Mineral Leases, Water-right Licenses, etc.



ORDERS IN COUNCIL FOR REGULATING GOLD MINING LEASES. (ACT 21 VICT. NO. 32.)

District.	Date of Order in Council.	Date of <i>Government Gazette</i> .	Page.
BALLAARAT - - -	20th December, 1858 - -	21st December, 1858 - -	2566
	3rd February, 1859 - -	8th February, 1859 - -	231
	8th April, 1859 - -	8th April, 1859 - -	715
	8th August, 1859 - -	9th August, 1859 - -	1655
MARYBOROUGH - - -	17th January, 1859 - -	25th February, 1859 - -	379
	10th October, 1859 - -	12th October, 1859 - -	2171
	4th June, 1860 - -	8th June, 1860 - -	1080
	15th October, 1860 - -	19th October, 1860 - -	1965
SANDHURST - - -	24th January, 1859 - -	15th February, 1859 - -	290
	19th May, 1859 - -	20th May, 1859 - -	1073
	30th August, 1859 - -	30th August, 1859 - -	1859
	6th February, 1860 - -	10th February, 1860 - -	278
CASTLEMAINE - - -	24th January, 1859 - -	1st March, 1859 - -	401
	30th August, 1859 - -	30th August, 1859 - -	1857
	6th February, 1860 - -	10th February, 1860 - -	276
BEECHWORTH - - -	28th May, 1860 - -	5th June, 1860 - -	1060
ARARAT - - -	27th August, 1860 - -	31st August, 1860 - -	1629

Order in Council of the 14th April, 1859 (*Government Gazette*, 16th April, 1859, page 805), prescribing the form of lease.

Order in Council of the 7th May, 1860 (*Government Gazette*, 11th May, 1860, page 879), relative to the execution, delivery, or cancellation of mining leases.

Order in Council of the 4th December, 1860 (*Government Gazette*, 7th December, 1860, page 2362), substituting the name of the Honorable the Commissioner of Mines for that of the Honorable the Chief Secretary.

Order in Council dated 16th September, 1861 (*Government Gazette* of 20th September, 1861, page 1779), rescinded all previous regulations relating to mining leases in the several mining districts, and made new regulations to apply to the whole of those districts.

ACT 25 VICT. No. 148.—Order in Council dated 13th October, 1862 (*Government Gazette*, 17th October, 1862, page 2007), made new regulations. An amended form of lease under these regulations was given in the *Government Gazette* of 13th January, 1865, page 78; Order in Council dated 12th December, 1864.

MINING STATUTE 1865, No. 291.—Order in Council dated 19th March, 1866 (*Government Gazette* 23rd March, 1866, page 659), rescinded previous regulations and made new ones. These were amended by an Order in Council of the 6th August, 1866, altering the wording of the lease to “cease, determine, and be absolutely void,” &c., and altering the number of days’ notice from “seven” to “six.”—*Government Gazette* of 10th August, 1866, page 1713, and of the 17th August, 1866, page 1777.

Order in Council dated 24th December, 1866 (*Government Gazette* of 11th January, 1867, page 59), rescinded previous regulations and made new ones. An amendment was made by Order in Council of 15th July, 1867, substituting the words “posts two feet six inches” for “posts three feet in height.”—*Government Gazette*, 19th July, 1867, page 1286.

Order in Council dated 2nd March, 1868 (*Government Gazette* of the 6th March, 1868, page 541), the regulations now in force.

Order in Council dated 9th November, 1868 (*Government Gazette* of the 13th November, 1868, page 2142), altering the attestation clause of lease.

ORDERS IN COUNCIL REGULATING LEASES OF LANDS CONTAINING MINERALS AND METALS OTHER THAN GOLD.

ACT 24 VICT., No. 117.—Order in Council dated 2nd September, 1861 (*Government Gazette*, 3rd September, 1861, page 1674, and 13th September, 1861, page 1736). An amended form of lease was given in the *Government Gazette* of 14th February, 1862, page 288; Order in Council dated 3rd February, 1862.

THE LAND ACT 1862.—Order in Council dated 5th August, 1862 (*Government Gazette*, 8th August, 1862, page 1394), made new regulations.

These were amended by Order in Council of 21st December, 1862—substituting the words “Warden’s Clerk or Clerk of Petty Sessions” for “Commissioner of Crown Lands or Warden of the Goldfields” (*Government Gazette*, 9th January, 1863, page 64). The Schedules to these regulations were also amended by Order in Council of the 5th January, 1863 (*Government Gazette*, 16th January, 1863, page 114, and of the 26th January, 1863; *Government Gazette*, 3rd February, 1863, page 287).

MINING STATUTE 1865, No. 291.—Order in Council dated 19th March, 1866 (*Government Gazette*, 23rd March, 1866, page 664), made new regulations; these were amended by Order in Council of the 20th August, 1866—altering the wording in the form of lease to “cease, determine, and be absolutely void,” and altering the number of days for notices—(*Government Gazette*, 28th August, 1866, page 1860).

Order in Council dated 24th December, 1866, (*Government Gazette*, 11th January, 1867, page 64), made regulations; these were amended by Order in Council of 15th July, 1866 (*Government Gazette*, 19th July, 1867, page 1286), making the rent payable yearly, and requiring posts two feet six inches above the ground to be erected.

Order in Council dated 2nd March, 1868 (*Government Gazette* of the 6th March, 1868, page 545), the regulations now in force.

Order in Council dated 9th November, 1868 (*Government Gazette* of the 13th November, 1868, page 2142), altering the attestation clause of lease.

ORDERS IN COUNCIL FOR REGULATING LICENSES AUTHORISING PERSONS TO CUT, CONSTRUCT, AND USE RACES, DAMS, AND RESERVOIRS.

ACT 25 VICT., No. 148.—Order in Council dated 22nd December, 1862 (*Government Gazette*, 9th January, 1863, page 62).

LAND ACT 1862.—Order in Council dated 21st November, 1864 (*Government Gazette*, 2nd December, 1864, page 2710), made new regulations.

MINING STATUTE 1865, No. 291.—Order in Council dated 19th March, 1866 (*Government Gazette*, 23rd March, 1866, page 670), made new regulations.

Order in Council dated 20th August, 1866 (*Government Gazette*, of the 28th August, 1866, page 1860), altering the number of days for notices.

Order in Council dated 24th December, 1866 (*Government Gazette*, 11th January, 1867, page 69), made new regulations.

Order in Council dated 15th July, 1867 (*Government Gazette*, 19th July, 1867, page 1286), made the regulations now in force.

Order in Council dated 29th October 1866 (*Government Gazette*, 6th November, 1866, page 2431), made regulations relative to the granting of leases of *Public Water Reservoirs*.

ORDERS IN COUNCIL, ETC., REGULATING LICENSES TO SEARCH FOR ANY METAL OR MINERAL EXCEPT GOLD.

ACT 24 VICT., No. 117.—Regulations dated 8th July, 1861, were issued by the Board of Land and Works, and published in the *Government Gazette* of the 12th July, 1861, page 1327.

THE LAND ACT 1862.—Order in Council dated 13th October, 1862 (*Government Gazette* 21st October, 1862, page 2032), made regulations under this Act.

Order in Council dated 1st June, 1863 (*Government Gazette*, 10th June, 1863, page 1300), made additional regulations.

MINING STATUTE 1865, No. 291.—Order in Council dated 19th March, 1866 (*Government Gazette*, 23rd March, 1866, page 669), made new regulations.

REGULATIONS RELATING TO GOLD MINING LICENSES AND LEASES, AND BUSINESS LICENSES, PASSED PRIOR TO THE ESTABLISHMENT OF LOCAL COURTS ON THE GOLDFIELDS.

<i>Gazette.</i>	<i>Date.</i>	<i>Gazette.</i>	<i>Date.</i>
1851 page 209	16th August, 1851.	1853 page 19	1st January, 1853.
1851 page 259	18th August, 1851.	1853 page 483	5th April, 1853.
1851 page 825	1st December, 1851.	1854 page 749	31st December, 1853.
1851 page 637	8th October, 1851.	1854 page 875	6th April, 1854.
1851 page 864	13th December, 1851.	1855 page 1419	12th June, 1855.
1852 page 1170	20th October, 1852.	1855 page 1542	29th June, 1855.

LOCAL COURT RULES PASSED PRIOR TO THE ESTABLISHMENT OF MINING BOARDS.

Gazette page.	Date of Notice.	Gazette page.	Date of Notice.	Gazette page.	Date of Notice.
2071	13th August, 1855.	1426	27th August, 1856.	904	22nd May, 1857.
2497	3rd October, 1855.	1427	27th August, 1856.	978	2nd June, 1857.
2498	3rd October, 1855.	1427	27th August, 1856.	978	2nd June, 1857.
2499	3rd October, 1855.	1473	5th September, 1856.	979	2nd June, 1857.
2499	3rd October, 1855.	1541	12th September, 1856.	989	2nd June, 1857.
2500	3rd October, 1855.	1551	12th September, 1856.	1040	12th June, 1857.
2500	3rd October, 1855.	1553	16th September, 1856.	1075	19th June, 1857.
2501	3rd October, 1855.	1586	19th September, 1856.	1199	3rd July, 1857.
2724	26th October, 1855.	1617	26th September, 1856.	1199	3rd July, 1857.
2765	26th October, 1855.	1617	26th September, 1856.	1306	17th July, 1857.
2806	30th October, 1855.	1659	3rd October, 1856.	1369	24th July, 1857.
2968	13th November, 1855.	1689	7th October, 1856.	1474	7th August, 1857.
3027	15th November, 1855.	1689	7th October, 1856.	1474	7th August, 1857.
3107	22nd November, 1855.	1747	17th October, 1856.	1522	4th August, 1857.
3107	27th November, 1855.	1747	17th October, 1856.	1459	7th August, 1857.
3128	28th November, 1855.	1812	28th October, 1856.	1569	21st August, 1857.
3176	4th December, 1855.	1812	28th October, 1856.	1570	21st August, 1857.
106	18th January, 1856.	1812	28th October, 1856.	1631	1st September, 1857. (2)
107	18th January, 1856. (3)	1861	4th November, 1856.	1631	1st September, 1857. (2)
217	4th February, 1856.	1885	7th November, 1856.	1715	11th September, 1857.
264	12th February, 1856.	1886	7th November, 1856.	1715	11th September, 1857.
335	15th February, 1856.	1886	7th November, 1856.	1751	11th September, 1857.
357	15th February, 1856.	2040	28th November, 1856.	1858	2nd October, 1857.
358	19th February, 1856.	2040	28th November, 1856.	1858	2nd October, 1857.
358	19th February, 1856.	2079	5th December, 1856.	1858	2nd October, 1857.
358	19th February, 1856.	2107	9th December, 1856.	1941	16th October, 1857.
358	19th February, 1856.	2172	19th December, 1856.	1942	16th October, 1857.
378	22nd February, 1856.	2158	16th December, 1856.	1942	16th October, 1857.
454	5th March, 1856. (2)	2189	23rd December, 1856.	1942	16th October, 1857.
455	5th March, 1856.	2212	26th December, 1856.	2061	30th October, 1857.
514	14th March, 1856.	2212	26th December, 1856.	2064	30th October, 1857.
537	18th March, 1856.	2213	26th December, 1856.	2064	30th October, 1857.
563	26th March, 1856.	2213	26th December, 1856.	2065	30th October, 1857.
630	8th April, 1856.	2213	26th December, 1856.	2130	6th November, 1857.
631	1st April, 1856. *	57	9th January, 1857.	2284	27th November, 1857.
631	8th April, 1856. †	128	20th January, 1857.	2341	4th December, 1857.
631	8th April, 1856.	128	20th January, 1857.	2374	11th December, 1857.
631	8th April, 1856.	146	23rd January, 1857.	2374	11th December, 1857.
631	8th April, 1856.	246	6th February, 1857.	2375	11th December, 1857.
771	2nd May, 1856. *	287	13th February, 1857.	2375	11th December, 1857.
771	2nd May, 1856. †	350	24th February, 1857.	2375	11th December, 1857.
772	2nd May, 1856.	308	17th February, 1857.	2375	11th December, 1857.
820	10th May, 1856.	350	24th February, 1857.	2393	14th December, 1857.
820	10th May, 1856.	434	6th March, 1857.	2397	14th December, 1857.
852	16th May, 1856.	565	27th March, 1857.	2443	18th December, 1857.
885	23rd May, 1856.	650	15th April, 1857.	2444	18th December, 1857.
918	3rd June, 1856.	651	15th April, 1857.	2482	24th December, 1857.
959	10th June, 1856.	684	21st April, 1857.	2482	24th December, 1857.
985	12th June, 1856.	684	21st April, 1857.	2523	31st December, 1857.
987	12th June, 1856.	684	21st April, 1857.	2523	31st December, 1857.
1164	15th July, 1856.	740	1st May, 1857.	2523	31st December, 1857.
1240	29th July, 1856.	741	1st May, 1857.	2523	31st December, 1857.
1240	29th July, 1856.	774	5th May, 1857.	2529	31st December, 1857.
1419	22nd August, 1856.*	903	22nd May, 1857.	2530	31st December, 1857.
1420	27th August, 1856. †	904	22nd May, 1857.		

* General.

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† Local.

LIST OF BYE-LAWS PASSED BY THE MINING BOARDS.

BALLAARAT DISTRICT.

Bye-law No. 1 passed on the 28th April, 1858, and gazetted on the 14th May, 1858, dealt with the following subjects:—Nos. 1 to 102. Standing orders; order of proceedings of the board; attendance of members; notices and motions; amendments; debate; committees of the whole; petitions; suspension of standing orders.

No. 2, passed on the 21st April, 1858, and gazetted on the 14th May, 1858, dealt with the following subject:—To interpret local court regulations for the District of Mount Egerton.

No. 3, passed on the 14th May, 1858, and gazetted on the 15th June, 1858, dealt with the following subjects:—No. 1, division of district; 2, appointment of surveyors; 3, method of laying off claims; 4, increase in size of claims; 5, decrease in size of claims; 6, datum for measurement of land; 7, mode of determining depth; 8, abolition of spare ground; 9, width of frontage claims; 10, taking possession of frontage claims; 11, proceeding to work; 12, notice of intention to amalgamate; 13, conditional registration; 14, discovery of the gutter; 15, junction; 16, name of lead after junction; 17, registration too far; 18, definition of a junction; 19, ground lying between leads; 20, party sinking on parallels; 21, parallels not to be sunk upon till the gutter is defined; 22, paying reef; 23, block claims; 24, 25, taking possession; 26, proceeding to work; 27, conditional registration; 28, area of claims; 29, surface claims not to prevent the working of leads; 30, manner of working surfacing claims; 31, old workings—size of claims; 32, old ground shall mean; 33, manner of working—prospecting; 34, prospecting; 35, 36, parties shall be entitled to; 37, discovery of a lead or other gold workings to be made known without delay; 38, prospecting grants nullified; 39, boundaries after discovery; 40, unsuccessful prospectors; 41, discovery of a lead or other workings while in another claim; 42, posting a notice, prospecting by boring; 43, boring; 44, worked like block claim. *Quartz Mining*—45, length of leaders or veins; 46, alluvial sinking on quartz; 47, prospecting for reefs; 48, mode of taking up claims. *General rules to be applied to all registered claims, whether frontage, block, or otherwise*—49, numbering of claims and manner of registration; 50, names of claimowners shall be posted; 51, marking miners' rights; 52, transfer of shares; 53, person transferring his share to present his ticket; 54, secretary to enter names of shareholders; 55, duplicate registry; 56, losing of miners' rights; 57, when a miner's right shall have expired; 58, absence; 59, secretary to give notice; 60, surveyor shall post notice of conditional transfer; 61, portions of shares; 62, responsibility of working forfeited shares; 63, working partner's responsibility; 64, sleeping partner's responsibility; 65, parties receiving gold to present transfer ticket; 66, when a share of gold is disputed; 67, surveyor to stop transfers; 68, size of claims not altered; 69, drawing slabs from abandoned claims; 70, furnishing shares; 71, additional shares; 72, plurality of claims or shares; 73, mode of proceeding to obtain one or two or more shares; 74, permission to hold claims in reserve; 75, abandonment of claims; 76, compensation; 77, plurality of applicants; 78, authority to surveyor; 79, dissolution; 80, extended areas allowed by the warden; 81, special permission to amalgamate; 82, amalgamated claims one claim; 83, mining partnerships; 84, taking advantage of foregoing regulations; 85, certificate from surveyor; 86, permission to occupy for residence; 87, areas for machinery, &c.; 88, notice of application; 89, damaging claims, roads, watercourses, &c.; 90, surveyors' bench marks; 91, repealing clause.

No. 4, passed on the 20th May, 1858, and gazetted on the 15th June, 1858, dealt with the following subject :—Person in charge of books containing transfers, &c., to give possession to chairman of mining board.

No. 5, passed on the 16th June, 1858, and gazetted on the 6th July, 1858, dealt with the following subject :—Warden on recommendation of mining board to confirm grants of water privileges.

No. 6, passed on the 4th October, 1858, and gazetted on the 10th December, 1858, dealt with the following subject :—Nos. 1 to 9, prescribing the mode by which the validity of disputed elections shall be decided.

No. 7, passed on the 6th December, 1858, and gazetted on the 14th December, 1858, dealt with the following subject :—Land applied for on lease protected.

No. 8, passed on the 14th February, 1859, and gazetted on the 15th April, 1859, dealt with the following :—Plan A referred to in bye-law gazetted on the 15th June, 1858.

No. 9, passed on the 9th May, 1859, and gazetted on the 7th June, 1859, dealt with the following subject :—Nos. 1 to 12, water regulations.

No. 10, passed on the 13th July, 1859, and gazetted 26th July, 1859, cancelled previous bye-laws prescribing the sizes and forms of claims held under miners' rights, and re-enacted the clauses with amendments. In addition, the bye-laws dealt with forfeiture of claims ; registration of claims ; class of mining defined by surveyor or registrar ; non-registration, &c., and conditions of forfeiture ; plurality of claims ; unregistered block claims ; taking possession of unregistered claims ; forfeiture of unregistered claims by abandonment.

No. 11, passed on the 2nd December, 1859, and gazetted 12th January 1860, cancelled the following bye-laws :—No. 3, gazetted 15th June, 1858 ; No. 5, gazetted 6th July, 1858 ; No. 9, gazetted 7th June, 1859 ; No. 10, gazetted 26th July, 1859 ; and in addition to the subjects named in previous bye-laws dealt with—appointment of mining registrars ; their office hours, duties, and fees ; application for frontage claims ; mode of defining lateral boundaries ; block claims not permitted within the parallels of a frontage lead until after boundaries are fixed ; stoppage of registration for claims, and re-opening of registration ; definition of a junction ; mode of defining width of frontage claims when leads converge ; registrars to avoid creating conflicting interests ; penalty for creating conflicting interests ; definition of leads forming a junction ; priority of right shall be based on priority of registration ; rights on tributary leads ; and order in which rights shall be obtained on junction leads ; registered claims shall be numbered ; definition of claims and shares ; mode of working and time for commencing to work upon claims ; name of company, name of secretary, and names of shareholders shall be posted ; secretary may sue and be sued on behalf of the company ; liens upon claims or shares shall be registered ; mode of transferring claims or shares ; registrar shall issue certificate ; claims may be transferred as security ; registrar shall mark mortgage upon register or transfer ticket ; companies shall adopt code of rules ; copy of rules shall be filed ; companies to keep register of strata ; furnishing shares ; registration and transfer of furnishing shares ; plurality of applicants for a claim or share ; auriferous earth and quartz may be stacked and registered ; registrar may descend shaft, &c. ; ventilation of claims ; timbering drives ; mining agreements may be filed and registered ; permanent residence claims ; residence claims not to be interfered with by mining ; compensation for injuries ; mode of taking possession of permanent residence claims ; registration of residence claims ; objections to the registration of residence claims ; transfer of

permanent residence claims; mortgage of permanent residence claims; form of unregistered residence claims; returns of registrations and of residence claims.

No. 12, passed on the 9th January, 1861, and gazetted on the 29th January, 1861, cancelled bye-law No. 11, except the last clause, and re-enacted the clauses with amendments, and in addition dealt with the following subjects:—Deputy registrars; subdivisions of registrars' divisions; registrars to provide skeleton maps; registrars to furnish returns to board; persons finally registered to furnish plans; registration books to be kept in a fire-proof safe; fees to be paid to the mining registrar; main drive to be constructed through the gutter; width of frontage claims near point of convergence; converging leads; tributary leads and junction leads; rights of shareholders in case of a junction; unregistered claims; taking possession of unregistered claims; mining interests to be transferable; liability of holders of shares worked by contract; cutting races to be considered working claim; number of shareholders may be reduced; machinery areas not to be undermined; accumulation of sludge, &c., not to be allowed; death of holder of claim, &c.; right of shareholders to benefit of discoveries; power to enter upon claims of other persons; title of owner not vitiated by absence; water races may be extended or altered; water to be left running in creeks, &c.

No. 13, passed on the 21st May, 1861, and gazetted on the 18th June 1861, cancelled bye-law No. 12, except the last clause, and re-enacted the clauses with amendments.

No. 14, passed on the 12th March, 1862, and gazetted on the 2nd May, 1862, cancelled bye-law No. 13 with the exception of the last clause, and re-enacted the clauses with amendments.

No. 15, passed on the 20th August, 1862, and gazetted on the 26th August, 1862, dealt with the following subject:—Election of managers of goldfields commons.

No. 16, passed on the 1st October, 1862, and gazetted on the 14th November, 1862, dealt with the following subject:—Registration of claims portions of which are situated in more than one division.

No. 17, passed on the 12th November, 1862, and gazetted on the 21st November, 1862, cancelled bye-law No. 15, and re-enacted the clauses, and in addition dealt with the following subject:—Furnishing of accounts by keepers of goldfields commons.

No. 3, passed on the 5th June, 1866, and gazetted on the 17th August, 1866, cancelled bye-laws Nos. 8, 14, and 16, except the last clause of No. 14, and re-enacted them, with the exception of those clauses relating to frontage claims, and in addition dealt with the following subjects:—Duties of district mining registrar; definition of claims; survey and registration of claims; title not to be injured by neglect of officer; boundaries to be defined; mining, &c., on reserves; executors, &c., may be registered; survey and registration of water rights.

No. 4, passed on the 25th September, 1866, and gazetted on the 2nd November, 1866, dealt with the following subjects:—Registration of claims under consolidated miners' rights; water allowed to holders of water rights; duplicate notice of registration of residence or business area to be posted; transfer of shares on one ticket; books of applications for mining tenements open for inspection free; registration of claims held under previous bye-laws; amended scale of fees for registrations, &c.

No. 5, passed on the 21st April, 1868, and gazetted on the 19th May, 1868, cancelled clauses 25 and 27 of bye-law No. 3, and re-enacted them with amendments.

No. 6, passed on the 7th October, 1868, and gazetted on the 23rd October, 1868, repealed clause 14 of bye-law 3, and re-enacted it with amendments.

BEECHWORTH DISTRICT.

Bye-law No. 1, passed on the 24th April, 1858, and gazetted on the 5th May, 1858, repealed the existing regulations of the local court of Beechworth.

No. 2, passed on the 24th April, 1858, and gazetted on the 5th May, 1858, repealed the existing regulations of the local court of Yackandandah.

Nos. 3 to 52, passed on the 24th April, 1858, and gazetted on the 5th May, 1858, dealt with the following subjects:—3, extent of ordinary claims; 4, extent of ordinary claims at Bowman's forest; 5, extent of claims on wet or flooded ground; 6, extent of claim in old worked or abandoned ground; 7, claims in beds of creeks or rivers; 8, quartz claims; 9, surfacing claims; 10, surfacing claims in Yackandandah and Omeo Divisions; 11, special protection to tail races; 12, amalgamation of claims; 13, united claims upon Eldorado Flat, Woolshed Creek; 14, time allowed for procuring machinery; 15, allowance of extra area to prospectors; 16, extended area of claim; 17, claims to be marked by pegs; 18, written application and registration of claims; 19, responsible party; 20, transfer of claims; 21, protection of claim while forwarding work; 22, protection to claims during floods or failure of water; 23, forfeiture of ordinary claims; 24, forfeiture of claims other than ordinary claims; 25, interpretation of term "wet or flooded ground;" 26, boundary line on opening new creeks; 27, water-course to be kept clear in beds of creeks; 28, penalty for removing pegs; 29, forcible possession of claims prohibited; 30, right of water at the creek; 31, water-rights, how obtained; 32, limitation of water-rights; 33, water for wheels; 34, right to water from springs; 35, diversion of water from unoccupied creeks; 36, diversion of surplus water from occupied creeks; 37, priority of rights out of the creek; 38, supply of water for the bed of the Nine-mile Creek; 39, control over tail water prohibited; 40, water to be resumed only on written sanction from the warden; 41, disposal of water during night in Yackandandah division; 42, tailings to be kept clear in beds of creeks; 43, tailings to be kept clear in the Yackandandah Division; 44, permission to cut races may be granted; 45, heads of races not to be shifted; 46, keeping races in repair, bridging, &c.; 47, protection to races during drought; 48, construction of dams; 49, abandonment of races; 50, interference with races prohibited; 51, supply of water to be held under permit, how gauged; 52, penalty for non-complying with warden's order.

No. 53, passed on the 15th May, 1858, and gazetted on the 16th July, 1858, dealt with the following subject:—Defining extent of ground to be occupied for residence or business purposes, and conditions on which the same may be entered for mining purposes.

Nos. 54 to 56, passed on the 1st July, 1858, and gazetted on the 16th July, 1858, cancelled bye-laws Nos. 7 and 10, and re-enacted them with amendments, and in addition dealt with the following subject:—Causing adjoining claims to be flooded—penalty.

No. 57, passed on the 27th July, 1858, and gazetted on the 24th August, 1858, cancelled bye-law No. 8, and re-enacted it with amendments; it also cancelled bye-law No. 40.

No. 58, passed on the 26th July, 1858, and gazetted on the 24th August, 1858, cancelled bye-law No. 37, and re-enacted it with amendments.

Nos. 59 to 73, passed on the 14th September, 1858, and gazetted on the 8th October, 1858, cancelled bye-laws Nos. 31, 35, 36, 38, and 58. They also cancelled and re-enacted with amendments bye-laws Nos. 32, 39, 44, and 51, and in addition

dealt with the following subjects:—Diversion of surplus water permitted; defining priority in races already cut; diversion of water from natural water-shed; notice to cease diversion so as to supply prior rights; storage of water in beds of creeks in Three-mile and Nine-mile Creek Divisions prohibited; registration of tail-races and tunnels; registration of assignment of races; extension of time for prospecting quartz claims; extended area of claim may be occupied by same number of men as original claim.

Nos. 74 to 83, passed on the 2nd November, 1858, and gazetted on the 12th November, 1858, cancelled bye-laws Nos. 12, 14, 33, 34, and 50, and re-enacted them with amendments, and in addition dealt with the following subjects:—Extent of ordinary claim at the Indigo, where the sinking exceeds fifty feet; extent of ordinary claim at the Indigo, where the sinking exceeds twenty feet, and not fifty feet; extra area allowed for prospecting half a mile from nearest shaft on the lead; regulating the occupation of business and residence sites.

Order in Council dated 22nd November, 1858, and gazetted on the 26th November, 1858, revoked bye-law No. 67.

Nos. 84 to 92, passed on the 16th December, 1858, and gazetted on the 31st December, 1858, cancelled bye-laws Nos. 15, 23, 24, 32, 71, and 79, and re-enacted them with amendments, and in addition dealt with the following subjects:—Allowance of extra area to prospectors at Bowman's Forest; extent of claim in ground partially wet; forfeiture of priority in registered races; transfer of priority in races.

Nos. 93 and 94, passed on the 22nd February, 1859, and gazetted on the 8th March, 1859, cancelled bye-law No. 80, and re-enacted it with amendments, and in addition dealt with the following subject:—Priority of right to water not forfeited in altered or extended race.

Nos. 95 to 121, passed on the 16th March, 1859, and gazetted on the 5th April, 1859, cancelled bye-laws Nos. 3, 4, 5, 6, 9, 16, 18, 20, 42, 54, 55, 75, 84, and 85, and re-enacted them with amendments, and in addition dealt with the following subjects:—Where gauge may be placed in Buckland and Omeo Divisions; claimholder may absent himself from claim when same is fairly opened; occupation of claims under frontage system; occupant of frontage claim must mark out and register claim; duties of the surveyor with respect to frontage claims; days on which the surveyor shall attend on the ground; notice to surveyor of lead having been struck; when claims may be occupied adjoining to frontage claims; limitation of width of frontage claim; extent of frontage that may be occupied; additional measurement down the lead; surface measurement to determine measurement of lead beneath; notice of transfer of interest to be given to surveyor; power to occupy under subsequent bye-laws; right of entry upon claim given to the surveyor; duty of surveyor to register transfers and amalgamations, and fees chargeable thereon; duty of surveyor to register claims under the frontage system, and fees chargeable thereon; how frontage system is to be applied in certain cases.

Nos. 122 to 124, passed on the 15th July, 1859, and gazetted on the 2nd August, 1859, cancelled bye-laws Nos. 88, 89, and 113, and re-enacted them with amendments.

Nos. 125 to 129, passed on the 26th August, 1859, and gazetted on the 6th September, 1859, cancelled bye-laws Nos. 53, 64, 69, 94, and 123, and re-enacted them with amendments.

Nos. 130 and 131, passed on the 15th December, 1859, and gazetted on the 6th January, 1860, dealt with the following subjects:—Protection to washdirt; puddling machines.

Nos. 132 to 166, passed on the 22nd March, 1860, and gazetted on the 20th April, 1860, cancelled bye-laws Nos. 74, 90, 106, 107, 108, 110, 112, 114, 115, 124, and 127. They also cancelled and re-enacted, with amendments, Nos. 11, 13, 21, 22, 17, 48, 57, 65, 95, 96, 97, 99, 103, 83, 119, 120, 121, and 122, and in addition dealt with the following subjects :—Discovery of payable ground in a prospecting claim to be reported ; number of men to be employed on prospecting claim ; area for quartz crushing machinery ; road or tramway to or from a claim to be permitted ; claims coming under frontage system ; increased length of claim ; width of frontage claims ; the surveyor to lay off frontage claims ; blocks to be laid off ; direction of blocks may be altered ; occupiers on a new lead to be entitled to the frontage claims on which their shafts are situated ; number of men to be employed on frontage claim ; frontage claims to be registered ; surveyors' duties ; provision for frontage claims occupied under frontage bye-laws passed previous to 1st March, 1860 ; interpretation bye-law.

Nos. 167 to 182, passed on the 14th July, 1860, and gazetted on the 16th November, 1860, cancelled bye-laws Nos. 72, 86, 100, 105, 116, 136, 138, 148, 149, 163, 164, and 166, and re-enacted them.

Nos. 183 to 188, passed 14th December, 1860, and gazetted on the 29th January, 1861, dealt with the following subjects :—Meaning of words "worked and abandoned ground ;" miners wishing to work ground in the bed of a creek on which a dam is erected ; surface claims, Omeo Division, to be marked off at right angles ; holders of creek bed claims, Snake Valley, Three-mile Creek, and Spring Creek Divisions, entitled to one sluice-head of water ; claims to be registered ; registrars' fees.

Nos. 189 to 191, passed on the 15th January, 1861, and gazetted on the 8th February, 1861, cancelled bye-law No. 146, and dealt with the following subjects :—Sites of reservoirs to be registered ; occupation for residence or business purposes not allowed within twelve feet of any race.

Nos. 1 to 20, passed on the 28th March, 1861, and gazetted on the 10th May, 1861, cancelled all previous bye-laws, and re-enacted them, with amendments.

Nos. 21 to 25, passed on the 6th August, 1861, and gazetted on the 24th September, 1861, cancelled portions of bye-laws Nos. 2 and 15, and re-enacted them, and in addition dealt with the following subjects :—Protection of roadways, sides of races and dams ; causing claims to be flooded, prohibited ; interference with races, dams, reservoirs, &c., prohibited.

Nos. 26 and 27, passed on the 19th November, 1861, and gazetted on the 13th December, 1861, cancelled a portion of bye-law No. 6, and re-enacted it with amendments, and defined the meaning of the words "when a claim is fairly opened and in working order."

Nos. 28 to 30, passed on the 7th January, 1862, and gazetted on the 31st January, 1862, cancelled portions of bye-laws Nos. 4, 25, and 27, and re-enacted them with amendments.

Nos. 1 to 25, passed on the 4th March, 1862, and gazetted on the 2nd May, 1862, cancelled all previous bye-laws, and re-enacted them with amendments.

Bye-law passed on the 26th August, 1862, gazetted on the 9th September, 1862, dealt with the following subject :—Management of the goldfields commons under the new *Land Act*.

Nos. 26 to 37, passed on the 26th August, 1862, and gazetted on the 9th September, 1862, cancelled portions of bye-laws Nos. 6, 7, 13, 20, 22, 23, and 25, and re-enacted them with amendments, and in addition dealt with the following subjects :—Dry bank claims ; frontage claims, Buckland Division ; creek claims, Omeo

Division ; extended areas which may be occupied by prospectors for undiscovered quartz reefs by means of tunnelling into mountain ranges ; extended areas which may be occupied by the proprietors of mining companies under the frontage bye-laws ; suspension of workings on frontage leads ; bridges.

Nos. 38 to 43, passed on the 18th November, 1862, and gazetted on the 2nd December, 1862, cancelled bye-law No. 33, and re-enacted it with amendments, and in addition dealt with the following subjects :—Right of surveyor to enter upon claims ; claimholders to benefit by bye-laws subsequently passed ; protection to posts, pegs, and notices ; protection to races and claims ; interpretation bye-law.

Nos. 44 and 45, passed on the 3rd February, 1863, and gazetted on the 17th February, 1863, cancelled portions of bye-laws Nos. 21 and 38, and re-enacted them with amendments.

Nos. 1 to 40, passed on the 10th March, 1863, and gazetted on the 2nd April, 1863, cancelled all previous by-laws in force, and re-enacted them with amendments, and in addition dealt with the following subjects :—Disputed elections ; liens upon claims and shares.

Nos. 41 to 45, passed on the 4th August, 1863, and gazetted on the 18th August, 1863, dealt with the following subjects :—Gauge to be placed in races ; evidence on oath as to necessity for granting permission to suspend working operations ; wet bank, dry bank, and creek claims in the Yackandandah Division to be surveyed ; dams and reservoirs in the Indigo Division to be registered.

Bye-law passed on the 4th August, 1863, and gazetted on the 18th August, 1863, cancelled previous bye-law passed on the 26th August, 1862, on the subject of management of goldfields commons under the new *Land Act*, and re-enacted it with amendments.

Bye-law passed on the 24th November, 1863, and gazetted on the 4th December, 1863, dealt with the following subject :—Providing for the auditing of the accounts of managers of goldfields commons, under the Act 145 Victoria.

No. 46, passed on the 24th November, 1863, and gazetted on the 4th December, 1863, dealt with the following subject :—Tail-race to be a portion of claim.

Nos. 47 to 49, passed on the 10th February, 1864, and gazetted on the 9th February, 1864, dealt with the following subjects :—Forfeiture of extended tunnelling claims ; leads or tunnels outside the boundaries of quartz claims to be part of claim ; disputes as to worked or abandoned ground.

No. 50, passed on the 8th March, 1864, and gazetted on the 18th March, 1864, cancelled No. 48, and re-enacted it with amendments.

No. 51, passed on the 19th April, 1864, and gazetted on the 29th April, 1864, dealt with the following subject :—Site for races.

No. 52, passed on the 22nd November, 1864, and gazetted on the 9th December, 1864, dealt with the following subject :—Area for site for a tramway.

Nos. 53 and 54, passed on the 30th January, 1865, and gazetted on the 14th February, 1865, cancelled No. 8, and dealt with the following subject :—Extended claims on frontage leads.

Bye-law passed on the 6th November, 1865, and gazetted on the 1st December, 1865, dealt with the following subject :—Rules and regulations for the management of the goldfields common in the Mining District of Beechworth.

Nos. 37 to 39, passed on the 6th March, 1866, and gazetted on the 20th April, 1866, dealt with the following subjects :—Reservoirs ; tailing dams in the Yackandandah Division ; residence and business sites.

Nos. 1 to 40, passed on the 1st May, 1866, and gazetted on the 7th August, 1866, cancelled existing bye-laws and re-enacted them with amendments.

Nos. 41 to 44, passed on the 6th August, 1866, and gazetted on the 12th October, 1866, cancelled existing bye-laws relating to the management of goldfields commons and re-enacted them with amendments, and dealt with the following subjects :—Direction of roads or tracks not to be interfered with in the Buckland and Omeo Divisions ; purposes for which fees received for depasturage on goldfields commons shall be paid ; compensation, how and when made.

Nos. 45 to 55, passed on the 19th November, 1866, and gazetted on the 25th January, 1867, amended Nos. 3, 6, 12, and 21, and, in addition, dealt with the following subjects :—Machinery to represent labor ; liability of holders of working portions of shares ; stacking quartz outside of claims ; dams in Indigo Division ; registrations, how effected ; absence from residence or business site ; water for domestic use.

Nos. 56 and 57, passed on the 5th March, 1867, and gazetted on the 22nd March, 1867, extended the provisions of bye-law No. 27 to the Omeo Division, and amended bye-law No. 43.

Nos. 58 to 60, passed on the 7th May, 1867, and gazetted on the 23rd May, 1867, dealt with the following subjects :—Dams ; shares in incorporated mining companies ; drainage.

Nos. 61 to 65, passed on the 9th July, 1867, and gazetted on the 2nd August, 1867, amended No. 9, and extended the provisions of the frontage bye-laws to Eldorado, and in addition dealt with the following subjects :—Claimholders to benefit by bye-laws passed subsequently ; reservoirs, Mitta-mitta Division ; survey of mining tenements.

Nos. 1 to 43, passed on the 19th November, 1867, and gazetted 31st March, 1868, cancelled existing bye-laws and re-enacted them with amendments.

SANDHURST DISTRICT.

Bye-law No. 1, passed on the 13th April, 1858, and gazetted on the 14th May, 1858, prescribed the mode in which the validity of disputed elections should be decided.

Bye-law No. 2, passed on the 13th April, 1858, and gazetted on the 21st May, 1858, dealt with the following subjects :—1, amendment of rules and regulations heretofore made by local courts ; 2, construction of words and terms ; 3, more claims than one may be held ; 4, work to be done on claim when marked ; 5, no greater extent of land to be claimed than authorized ; 6, number of miners at work to be in proportion to ground ; 7, extent of claim in alluvial ground not being a puddling claim ; 8, different form of claims in creeks, &c., authority of warden to be obtained ; 9, no deep sinking allowed within certain distance of creeks ; 10, extent of claim for puddlers ; 11, length of claim on quartz lodes ; 12, breadth of quartz claim across the lode or vein ; 13, warden to fix line of lode when parties cannot agree ; 14, increase of claim for prospecting ; 15, claims under business license ; 16, claim for residence under miner's right ; 17, claim may be taken up over termination of drive ; 18, amalgamation for prospecting purposes ; 19, one shaft sufficient for two or more short claims ; 20, alluvial earth and quartz not to be held together ; 21, no unauthorized notice to be left on claim, &c. ; 22, alluvial claims to be properly marked by pegs ; 23, boundaries of quartz claims to be marked ; 24, claims for residence under miner's right or business license to be marked ; 25, registration of quartz claims ; 26, no walls

unless absolutely necessary for safety ; 27, flooded claims, how dealt with ; 28, authority to make waterholes, &c., to be obtained ; 29, waterhole, &c., to be commenced within certain time ; 30, waterholes or dams to be properly made ; 31, dams not to be made near reefs ; 32, water not to be taken from dams, &c. ; 33, machines not to be placed on workable ground ; 34, drains from machines, &c., to be made ; 35, drains may be ordered to be made, repaired, &c. ; 36, protection to sludge drains ; 37, protection to drainage ground ; 38, puddler's claim held unworked while road is being made ; 39, puddlers may hold claim when water is exhausted ; 40, claim may be declared to be relinquished if not fairly worked ; 41, valuation of work done in claim allowed ; 42, when sludge damages roads, &c., machines may be stopped ; 43, no sludge or water to be run upon roads, &c. ; 44, barrow track to be protected ; 45, protection to private roads ; 46, warden may order crossing-place, &c., to be made ; 47, no dwellings or machines to be erected too near roads ; 48, breadth of ground to be left for roads ; 49, shafts and excavations near roads to be secured ; 50, admission to measure claims allowed ; 51, admission to test stuff ; 52, entry upon land for mining purposes held for residence or business ; 53, stacked quartz stone not to be removed ; 54, washing-stuff to be properly stacked ; 55, puddlers not to pump water away from other miners ; 56, no sludge or waterhole to be cut to the damage of any other miner ; 57, warning to be given previous to blasting ; 58, air passages may be ordered to be made ; 59, obstructions on certain creeks may be removed ; 60, warden may remove dwelling-places, &c., too near to others.

No. 3, passed on the 13th April, 1858, and gazetted on the 21st May, 1858, dealt with the subject of sludge drains as follows :—1, grouping of gullies into districts ; 2, district committees established ; 3, mode of election of committee ; 4, voting to be by ballot ; 5, scrutineers may be appointed ; 6, declaration of the candidates elected ; 7, mode of filling vacancies in committees ; 8, power of district committee ; 9, district fees to be levied ; 10, labor contribution may be demanded ; 11, central drainage committee established ; 12, power of central committee and jurisdiction ; 13, fees to be paid by certain districts to central committee ; 14, appointment of officers, &c., by committees ; 15, central committee may manage districts if no district committee is elected ; 16, chairman to be appointed, &c. ; 17, report and balance-sheet to be presented to mining board every six months ; 18, no contractor to sit on central or district committee ; 19, payment of fees, how enforced ; 20, interpretation of words.

No. 4, passed on the 13th April, 1858, and gazetted on the 21st May, 1858, dealt with the following subject :—*Drainage of reefs*—No. 1, formation of local drainage committees ; 2, meeting of committee and election of chairman ; 3, power of committee.

Bye-law passed on the 13th April, 1858, and gazetted on the 30th July, 1858, amended bye-law for the drainage of quartz reefs.

Bye-law passed on the 20th August, 1858, and gazetted on the 21st September, 1858, amended bye-law for the better management of sludge drains.

Bye-law passed on the 16th November, 1858, and gazetted on the 30th November, 1858, amended bye-law for the better management of sludge drains.

Bye-law passed on the 13th April, 1858, and gazetted on the 7th January, 1859, dealt with the following subject :—Survey of sites for puddling machines, waterholes, dams, &c.

Bye-law passed on the 7th December, 1858, and gazetted on the 18th January, 1859, amended bye-law No. 2, regulating mining operations in the Mining District of Sandhurst.

Bye-law passed on the 24th December, 1858, and gazetted on the 18th January, 1859, amended bye-law for the better management of sludge drains.

Bye-law passed on the 19th January, 1859, and gazetted on the 25th January, 1859, dealt with the following subject :—Ground applied for on lease protected.

Bye-law passed on the 21st May, 1859, and gazetted on the 3rd June, 1859, regulated the proceedings of the Sandhurst Mining Board.

Bye-law passed on the 27th September, 1859, and gazetted on the 29th November, 1859, cancelled previous bye-laws, with the exception of the bye-law prescribing the mode in which disputed elections shall be decided, and the bye-law protecting ground applied for on lease; and re-enacted previous bye-laws with amendments, with the exception of the bye-law for the better management of sludge drains, and the bye-law for the drainage of reefs.

Bye-law passed on the 15th November, 1860, and gazetted on the 18th January, 1860, dealt with the following subjects :—Repairing, clearing, and keeping clear sludge and water channels ; assessment on horse puddling machines, &c. ; assessment on steam puddling machines ; assessment on other steam engines ; when assessments payable ; labor contribution may be required ; board may appoint officers ; powers of officers, &c. ; duties of collector ; duties of superintendent, finance committee, &c. ; subdivision of Sandhurst Division ; interpretation clause.

Bye-law passed on the 23rd February, 1861, and gazetted on the 9th May, 1861, cancelled all previous bye-laws excepting the bye-law for prescribing the mode in which disputed elections shall be decided, the bye-law regulating the proceedings of the mining board, and the bye-law regulating the drainage of sludge in the Sandhurst Division ; and re-enacted the clauses with amendments. In addition, it dealt with the following subject :—Rules and regulations for mining partnerships.

Bye-law passed on the 27th September, 1861, and gazetted on the 25th October, 1861, amended the sludge bye-law.

Bye-law passed on the 21st January, 1862, and gazetted on the 2nd May, 1862, dealt with the following subject :—Miners or speculators desirous of searching for the Old McIvor Lead.

Bye-law passed on the 28th July, 1862, and gazetted on the 26th August, 1862, dealt with the following subject :—*Frontage system*—Declaration of frontage lead ; deputy registrar ; fees to be paid to registrars ; liens upon shares to be registered ; transfer of shares by companies ; shares transferable ; possession of and registration of abandoned claims ; liability of holders of shares worked by contract ; abandonment of shares ; interpretation clause.

Bye-law passed on the 31st July, 1862, and gazetted on the 26th August, 1862, dealt with the following subject :—Drainage of sludge and water in the Heathcote Division of the Sandhurst Mining District as follows: Heathcote Division divided into wards ; mode of forming committee ; qualification of electors ; qualification of candidates ; appointment of scrutineers ; voters to produce miners' rights ; ballot ; ballot-papers to be counted ; chairman to be elected ; quorum and deputy chairman ; members may resign, &c., &c. ; duration of committee ; assessment ; notice of abandonment ; quarterly report ; interpretation clause.

Bye-law passed on the 15th September, 1862, and gazetted on the 30th September, 1862, amended the sludge bye-law.

Bye-law passed on the 5th January, 1863, and gazetted on the 20th January, 1863, cancelled, with certain exceptions, all the previous bye-laws, and re-enacted the clauses with amendments.

Bye-law passed on the 12th January, 1863, and gazetted on the 23rd January, 1863, amended bye-law regulating the drainage of sludge and water in the Heathcote Division.

Bye-law passed on the 24th February, 1863, and gazetted on the 13th March, 1863, cancelled previous sludge bye-law, and re-enacted it with amendments.

Bye-law passed on the 28th May, 1863, and gazetted 10th June, 1863, provided for the election of managers of the goldfields commons within the Mining District of Sandhurst.

Bye-law passed on the 18th June, 1863, and gazetted on the 3rd July, 1863, added to general bye-law a regulation relative to persons mining on tribute.

Bye-law passed on the 25th June, 1863, and gazetted on the 7th July, 1863, amended clause 23 of the general bye-law.

Bye-law passed on the 17th September, 1863, and gazetted on the 29th September, 1863, amended clause 10 of the general bye-law.

Bye-law passed on the 2nd October, 1863, and gazetted on the 16th October, 1863, dealt with the following subject :—Registration of residence.

Bye-law passed on the 8th October, 1863, and gazetted on the 23rd October, 1863, amended clause 21 of general bye-law.

Bye-law passed on the 12th November, 1863, and gazetted on the 20th November, 1863, dealt with the following subject :—Shepherding claims.

Bye-law passed on the 19th November, 1863, and gazetted on the 27th November, 1863, cancelled previous bye-law relating to shepherding claims, and re-enacted it with amendments.

Bye-law passed on the 21st January, 1864, and gazetted on the 29th January, 1864, cancelled a portion of the general bye-law relating to claims to be registered, and re-enacted it with amendments.

Bye-law passed on the 22nd February, 1864, and gazetted on the 4th March, 1864, cancelled previous bye-laws, with certain exceptions, and re-enacted the clauses with amendments.

Bye-law passed on the 26th May, 1864, and gazetted on the 30th June, 1864, passed the following as an addition to the general bye-law :—Lien clause.

Bye-law passed on the 23rd June, 1864, and gazetted on the 30th June, 1864, cancelled portions of general bye-law relating to shepherding, and puddling, and cement crushing, and re-enacted the clauses with amendments.

Bye-law passed on the 24th November, 1864, and gazetted on the 9th December, 1864, cancelled portions of general bye-law relating to alluvial claims and absence from claim, and re-enacted the clauses with amendments.

Bye-law passed on the 8th December, 1864, and gazetted on the 17th January, 1865, cancelled certain portions of general bye-law relating to fees, and substituted a fresh scale.

Bye-law passed on the 19th June, 1866, and gazetted on the 27th July, 1866, dealt with the following subject :—Drainage.

Bye-law passed on the 26th April, 1866, and gazetted on the 14th August, 1866, cancelled previous bye-laws, with certain exceptions, and re-enacted the clauses (with the exception of those relating to drainage) with amendments.

Bye-law passed on the 12th September, 1866, and gazetted on the 5th October, 1866, dealt with the following subject :—Drainage.

Bye-law passed on the 7th November, 1866, and gazetted on the 7th December, 1866, repealed the 13th clause of section 4 of the general bye-law, and enacted an amended bye-law.

Bye-law passed on the 30th January, 1867, and gazetted on the 15th February, 1867, re-enacted the drainage bye-law.

Bye-law passed on the 13th May, 1868, and gazetted on the 26th June, 1868, cancelled the sludge bye-law.

MARYBOROUGH DISTRICT.

Bye-law passed on the 10th April, 1858, and gazetted on the 5th May, 1858, prescribed the mode for trying the validity of disputed elections.

Bye-laws passed on the 14th May, 1858, and gazetted on the 29th June, 1858, dealt with the following subjects:—*Alluvial sinkings*—1, prospecting; 2, extent of claim in new ground; 3, marking claims; 4, the wall; 5, shepherding; 6, ground to be secured with props; 7, measurement of disputed ground; 8, extent of claim in old ground; 9, forfeited shares; 10, wet sinkings; 11, extent of claim in wet sinkings; 12, claims to be marked; 13, the wall; 14, wet sinkings, how to be worked; 15, water-bailing and night-work; 16, measurement of disputed ground; 17, extent of claim in old ground in wet sinkings; 18, drawing slabs from abandoned shafts. *Quartz reefs*—19, prospecting quartz reefs; 20, prospecting claim on quartz reef; 21, extent of claim; 22, claims, how to be marked; 23, the wall; 24, water-bailing and night-work; 25, registration of claims; 26, claims remaining unworked; 27, plurality of claims in quartz mining; 28, names of shareholders must be kept posted; 29, shareholders may employ themselves elsewhere during the sinking of the shaft. *General rules*—30, justifiable absence from claim; 31, injury to shafts; 32, waterholes for domestic use; 33, public holidays; 34, public highways; 35, holding of claims; 36, inspection of ground; 37, preservation of waterholes for mining purposes; 38, forcible possession; 39, effacing, &c., notices; 40, wilfully cutting channels.

Bye-law passed on the 9th April, 1858, and gazetted on the 2nd July, 1858, prescribed the standing orders of the Mining Board of Maryborough.

Bye-laws passed on the 31st May, 1858, and gazetted on the 2nd July, 1858, dealt with the following subjects:—*Amalgamation of claims*—41, amalgamation of claims; permission for amalgamated claims; application to state particulars; notice of application; objections to be made to the warden or other authorized person. *Water privileges*—42, permission to erect puddling machines, water dams, steam engines, &c., notice to be posted; 43, objections to be made; 44, transfer of water privileges; 45, excavation of water dams; 46, must give publicity if gold be found; 47, disposing of sludge; 48, roads to be bridged; 49, protection to drains; 50, further protection to drains; 51, area for puddling machine; 52, land occupied for residence; 53, land to be occupied by virtue of a business license; 54, notice to be posted on discovery of gold.

Bye-laws passed on the 12th June, 1858, and gazetted on the 2nd July, 1858, dealt with the following subjects:—55, frontage; 56, frontage system; 57, extent and position of claims; 58, extended ground for steam machinery; 59, proceeding to work; 60, marking of miners' rights; 61, transfer of shares or portions of shares; 62, registration of claims, shares, or sleeping interest; 63, absence from claim a forfeiture; 64, forfeiture of shares or portions thereof; 65, names of claimholders shall be posted; 66, professional transfer; 67, posting a notice; 68, discovering lead, or gutter, or payable ground; 69, position of claim in case of deviation of lead; 70, abandoned frontage leads; 71, the surveyor or any authorized person's books.

Bye-law passed on the 19th June, 1858, and gazetted on the 2nd July, 1858, dealt with the following subject:—72, protection of water-races.

Bye-law passed on the 3rd July, 1858, and gazetted on the 9th July, 1858, enacted an additional clause to the bye-law prescribing the standing orders for the mining board.

Bye-law passed on the 20th July, 1858, and gazetted on the 3rd September, 1858, provided for non-possession of miner's right by shareholder.

Bye-law passed on the 9th April, 1858, and gazetted on the 7th September, 1858, provided a special rule for the first erecting steam machinery in wet abandoned leads.

Bye-law passed on the 4th September, 1858, and gazetted on the 1st October, 1858, dealt with the following subjects:—1, water privileges; 2, special notice for water privileges; 3, priority of water-right; 4, protection to water-races.

Bye-law passed on the 9th October, 1858, and gazetted on the 19th November, 1858, cancelled bye-law imposing a fine on a member of the board absenting himself.

Bye-law passed on the 20th September, 1858, and gazetted on the 14th December, 1858, dealt with the following subject:—Extension of frontage for machinery.

Bye-law passed on the 4th December, 1858, and gazetted on the 7th January, 1859, dealt with the following subject:—Working of beds of rivers or creeks for sluicing purposes.

Bye-law passed on the 18th December, 1858, and gazetted on the 7th January, 1859, dealt with the following subject:—Registration of claims on quartz reefs.

Bye-law passed on the 8th January, 1859, and gazetted on the 1st February, 1859, dealt with the following subject:—Water-gauges.

Bye-law passed on the 22nd January, 1859, and gazetted on the 1st February, 1859, provided for protection to land applied for on lease.

Bye-laws passed on the 23rd May, 1859, and gazetted on the 17th June, 1859, cancelled previous bye-laws, and re-enacted the clauses with amendments, and, in addition, dealt with the following subjects:—Mortgages on claims; claims belonging to deceased individuals; area of ground under business license; streets; space to be left between allotments. *Extended claims*—Power to grant extended claims; old ground, dry sinking; old ground, wet sinking; quartz reefs; applications; objections; conditions; names of shareholders; form of claim.

Bye-law passed on the 1st August, 1859, and gazetted on the 6th September, 1859, dealt with the following subjects:—Surveyors' fees; old ground; dry water-bailing; wet alluvial sinking.

Bye-law passed on the 15th August, 1859, and gazetted on the 6th September, 1859, dealt with the following subjects:—Registration; prospecting quartz reefs.

Bye-laws passed on the 17th October, 1859, and gazetted on the 18th November, 1859, dealt with the following subjects:—Order of proceedings of the Mining Board of Maryborough; attendance of members; notices and motions; amendments; debate; divisions; committees of the whole; petitions; suspension of standing orders.

Bye-laws passed on the 19th December, 1859, and gazetted on the 20th January, 1860, dealt with the following subjects:—Non-forfeiture; non-forfeiture of shares through neglect of employed labor.

Bye-laws passed on the 25th January, 1860, and gazetted on the 3rd February, 1860, cancelled portion of frontage bye-law, and re-enacted it with amendments, and prescribed surveyors' fees under general bye-laws.

Bye-law passed on the 22nd February, 1860, and gazetted on the 28th February, 1860, cancelled a portion of dry alluvial sinking bye-law, and re-enacted it with amendments.

Bye-law passed 15th September, 1860, and gazetted on the 23rd October, 1860, dealt with the following subject:—Extent of claim for discovering new goldfield or workings in alluvial sinkings.

Bye-laws passed on the 26th October, 1860, and gazetted on the 15th January, 1861, cancelled all previous bye-laws regulating mining operations, and re-enacted the clauses with amendments.

Bye-law passed on the 1st April, 1861, and gazetted on the 14th June, 1861, repealed bye-law prescribing how to take possession of any claim, and re-enacted it with amendments.

Bye-laws passed on the 7th October, 1861, and gazetted on the 3rd December, 1861, cancelled previous bye-laws regulating mining operations, and re-enacted the clauses with amendments.

Bye-law passed 19th July, 1862, and gazetted on the 5th August, 1862, dealt with the following subject:—*Drainage*—Application for drainage committee; notice of application; application to registrar for plan; mining registrar to make surveys, &c.; objections; hearing of application; vacancies amongst members of committee; notice of application to fill vacancies; hearing of such application; duties of mining registrars; mining registrars' fees.

Bye-law passed on the 17th July, 1862, and gazetted on the 26th September, 1862, dealt with the following subject:—Election of managers of the goldfields commons within the Mining District of Maryborough.

Bye-law passed on the 21st October, 1862, and gazetted on the 21st November, 1862, cancelled all previous bye-laws excepting the bye-laws relating to disputed elections and the bye-law regulating the proceedings of the mining board; and re-enacted the clauses (with the exception of those relating to drainage) with amendments. It also dealt, in addition, with the following subjects:—Non-appointment or neglect of mining registrar or surveyor; number of shareholders may be reduced; felling trees across public roads; machines, tailings, &c., obstructing creeks; relating to mortgages; register of mortgages; index to register of mortgages and search-book; inspection of register of mortgages; release of mortgages.

Bye-law passed on the 13th June, 1863, and gazetted on the 23rd June, 1863, dealt with the following subject:—Protection to claimholders in wet alluvial workings.

Bye-laws passed on the 4th December, 1863, and gazetted on the 22nd January, 1864, cancelled all the previous bye-laws excepting the bye-law relating to disputed elections, and the bye-law regulating the proceedings of the mining board; it dealt, in addition, with the following subjects:—Rock sinking; protection to shafts; prevention of accidents from foul air. *Drainage*—Application for drainage committee; notice of application; application to registrar for plan; mining registrar to make plans; objections; hearing of application; vacancies amongst members of committee; notices of application to fill vacancies; hearing of such applications; mining registrars' fees; appointment of managers of goldfields commons.

Bye-law passed on the 16th April, 1864, and gazetted on the 29th April, 1864, cancelled bye-law section No. 121, and a portion of No. 116, and re-enacted them with amendments.

Bye-law passed on the 26th August, 1864, and gazetted on the 13th September, 1864, cancelled previous bye-laws, with certain exceptions, and re-enacted the clauses, except those relating to drainage and the appointment of managers of goldfields commons.

Bye-law passed on the 10th July, 1865, and gazetted on the 25th July, 1865, provided for the management of goldfields commons.

Bye-law No. 1, passed on the 17th September, 1866, and gazetted on the 16th November, 1866, cancelled previous bye-laws, and re-enacted the clauses with amendments.

Bye-law No. 2, passed on the 17th September, 1866, and gazetted on the 16th November, 1866, dealt with the following subject:—*Drainage of quartz reefs*—1, drainage areas to be granted; 2, mode of application for area where drainage machinery is proposed to be erected; 3, application for area where machinery is erected; 4, extension of drainage areas; 5, duties of mining registrars; 6, of water level, &c.; 7, sinking of shafts; 8, claims may be registered; 9, drainage rates, when chargeable; 10, of application for area where more than one drainage plant has been erected; 11, breaking of machinery or relinquishment of grant; 12, of natural obstruction to drainage; 13, accounts may be examined; 14, fees, how to be collected; 15, principle on which drainage shall be charged; 16, private agreements to be binding.

Bye-law No. 3, passed on the 17th September, 1866, and gazetted on the 16th November, 1866, dealt with the following subjects:—*Disposal of sludge*—1, power to appropriate funds under this bye-law; 2, contributions may be levied; 3, assessment on horse puddling machines, &c.; 4, assessment on steam puddling machines; 5, assessment on steam crushing machines; 6, when assessments payable; 7, appointment of officer; 8, conditions.

Bye-law passed on the 20th March, 1867, and gazetted on the 7th May, 1867, cancelled previous bye-law regulating the management of goldfields commons, and re-enacted the clauses with amendments.

Bye-law passed on the 12th February, 1868, and gazetted on the 10th March, 1868, cancelled the previous drainage bye-law, and enacted the following clauses:—1, interpretation clause; 2, application for a grant of a drainage area, how to be made; 3, objections to the issuing of a grant for a drainage area, how to be made; 4, mining board to deal with applications and objections; 5, grants for drainage areas to be registered; 6, owners of any claim in a drainage area who erect draining machinery on their claim may apply for cancellation of original grant, and issuing of fresh one in duplicate apportioning the drainage rates; 7, transfer of grant of a drainage area; 8, relinquishment of a grant for a drainage area; 9, transferee or mortgagee in possession of a claim in a drainage area liable for same amount of rates as transferrer or mortgagor; 10, drainage rates, when to be paid, and in default, how recoverable; 11, decision of arbitrators to be given in writing; 12, owners of amalgamated claims liable for same amount as they were liable for previous to amalgamation; 13, efficient drainage; 14, measurements; 15, expiration of grant for a drainage area; 16, rates, how to be disbursed.

Bye-law passed on the 27th August, 1868, and gazetted on the 22nd September, 1868, cancelled the bye-law relating to standing orders, and re-enacted it with amendments.

CASTLEMAINE DISTRICT.

Bye-law No. 1, passed on the 25th May, 1858, and gazetted on the 4th June, 1858, amended the regulations made by the various local courts within the Mining District of Castlemaine.

Bye-law passed on the 28th June, 1858, and gazetted on the 13th July, 1858, dealt with the following subjects:—Standing orders of the Mining Board of Castlemaine; petitions.

Bye-laws passed on the 29th and 30th June, 1858, and gazetted on the 13th July, 1858, dealt with the following subjects:—*Quartz workings*—No. 1, marking claims; 2, extent of ordinary claims on new reefs; 3, extent of claim on abandoned reefs; 4, base lines, cross lines, and width of claims; 5, wall; 6, proprietors' names and number; 7, blasting; 8, wet quartz claim; 9, water in old shafts or openings; 10, pumping by steam or other efficient machinery; 11, waterholes on quartz claims; 12, tunnelling claims on quartz reefs; 13, amalgamation of claims; 14, erection of machinery; 15, stacking auriferous substances on claims about to be relinquished; 16, crushing machines; 17, quartz and alluvial earth may be held conjointly in one claim; 18, timbering quartz claims. *Alluvial workings*—19, marking; 20, extent of claim (shallow); 21, extent of claim (deep); 22, old workings; 23, drains on wet claims; 24, discovery of deposits and leads of gold; 25, associated mining claims; 26, puddlers' claim; 27, puddlers' extended claim; 28, reservoirs for sludge; 29, water channels for extended claim. *Sluicing*—30, claims for sluice-washing; 31, head and tail races for sluicing; 32, tunnelling ground; 33, priority of claims. *General bye-laws*—34, waterholes for domestic purposes; 35, waterholes and dams; 36, to preserve creeks and rivers from obstruction by refuse matter; 37, measuring drives; 38, registration; 39, claims, when deemed relinquished; 40, shares in claims, and hired labor; 41, written agreements; 42, authorized occupation; 43, disputes; 44, felling trees across public roads; 45, mining near roads or crossing-places; 46, holes near roads to be fenced; 47, buildings, &c., near roads; 48, bridges; 49, destroying notices, pegs, &c., &c.; 50, nuisances; 51, protection to buildings on purchased land; 52, business sites; 53, occupation for residence under miner's right; 54, mining on residence or business site; 55, tents or private dwellings; 56, claims belonging to deceased individuals; 57, clerk to furnish schedules; 58, fees for schedules.

Bye-laws passed on the 12th August, 1858, and gazetted on the 20th August, 1858, dealt with the following subjects:—No. 59, companies to be registered; 60, valid objections to applications may be entertained; 61, protection to parties applying for ground, &c.; 62, valuation of mining plant allowed; 63, non-forfeiture of claims through neglect of hired workmen; 64, mortgages on claims; 65, justifiable absence from claim; 66, warden authorized to inflict penalty attached to breach of bye-laws.

Bye-laws passed on the 14th August, 1858, and gazetted on the 24th August, 1858, dealt with the following subjects:—67, surveyor's duties and scale of fees; 68, sludge; 69, drains may be ordered to be made.

Bye-law passed on the 13th August, 1858, and gazetted on the 7th September, 1858, cancelled bye-law No. 28, on sludge reservoirs.

Bye-law passed on the 3rd November, 1858, and gazetted on the 12th November, 1858, cancelled bye-law No. 36, and re-enacted it with amendments. It also amended bye-law No. 32.

Bye-laws passed on the 1st November, 1858, and gazetted on the 12th November, 1858, cancelled bye-law No. 39, and re-enacted it with amendments. It also amended bye-laws Nos. 2, 20, and 21.

Bye-law passed on the 10th January, 1859, and gazetted on the 18th January, 1859, amended bye-law No. 32.

Bye-law passed on the 2nd February, 1859, and gazetted on the 8th February, 1859, dealt with the following subject:—Protection to applicants under leasing regulations.

Bye-laws passed on the 21st April, 1859, and gazetted on the 10th May, 1859, cancelled all previous bye-laws, except the bye-law for standing orders of the Mining Board of Castlemaine, and re-enacted the clauses with amendments. In addition, they dealt with the following subjects :—Associated mining claims ; associated mining claims in narrow gullies ; water privilege for races ; water wheels ; extension of races ; erection of machinery ; measuring drives ; cross drives for ventilation to be made in tunnelling ground ; roads through claims ; applications.

Bye-law passed on the 23rd August, 1859, and gazetted on the 30th August, 1859, dealt with the following subject :—Protection to quartz mining companies or associations.

Bye-law passed on the 4th October, 1859, and gazetted on the 14th October, 1859, prescribed the mode in which the validity of disputed elections shall be determined.

Bye-law passed on the 1st May, 1860, and gazetted on the 8th May, 1860, dealt with the following subject :—No person shall deposit tailings or other matter so as to obstruct flow of water in Campbell's Creek and Forest Creek.

Bye-law passed on the 12th July, 1860, and gazetted on the 7th August, 1860, repealed clause 2 of bye-law regulating the standing orders of the mining board, and re-enacted it with amendments.

Bye-laws passed on the 15th October, 1860, and gazetted on the 6th November, 1860, cancelled all previous bye-laws, with certain exceptions, and re-enacted the clauses, and, in addition, dealt with the following subjects :—Limitation of width on surface of quartz claims ; quartz reefs in alluvial workings ; permission to enter claims ; definition of term "payable gold ;" sale of road frontages on auriferous ground ; protection to purchased land ; protection to claims under injunction.

Bye-law passed on the 3rd May, 1861, and gazetted on the 21st May, 1861, amended the bye-law for abatement of sludge nuisance in Forest and Campbell's Creeks.

Bye-laws passed on the 3rd May, 1861, and gazetted on the 2nd July, 1861, cancelled the bye-law relating to standing orders, and re-enacted it with amendments.

Bye-law passed on the 11th July, 1861, and gazetted on the 25th October, 1861, cancelled certain bye-laws, and re-enacted them with amendments. It also dealt with the following subject :—Enforcing the drainage of claims under certain regulations.

Bye-laws Nos. 1 to 72, passed on the 2nd August, 1862, and gazetted on the 22nd August, 1862, cancelled bye-laws Nos. 1 to 80, and re-enacted them with amendments. In addition, they dealt with the following subjects :—Temporary union of claims ; permission to enter claims ; liens on claims ; goldfields commons.

Bye-law No. 73, passed on the 21st October, 1862, and gazetted on the 31st October, 1862, imposed additional registration and survey fees.

Bye-laws passed on the 18th August, 1863, and gazetted on the 28th August, 1863, cancelled bye-laws Nos. 1 to 73, and, with certain exceptions, re-enacted the clauses with amendments.

Bye-law passed on the 23rd September, 1863, and gazetted on the 1st October, 1863, cancelled a portion of bye-law No. 5, and re-enacted it with amendments.

Bye-law passed on the 30th November, 1863, and gazetted on the 8th December, 1863, dealt with the following subject :—Stacking auriferous substances.

Bye-law passed on the 10th October, 1864, and gazetted on the 18th October, 1864, cancelled all previous bye-laws, and re-enacted the clauses, with the exception of those relating to the standing orders.

Bye-law passed on the 21st November, 1864, and gazetted on the 2nd December, 1864, dealt with the following subject :—Claims in banks and beds of rivers.

Bye-law passed on the 9th January, 1865, and gazetted on the 17th January, 1865, dealt with the following subject :—Regulating the working of claims.

Bye-law passed on the 18th June, 1867, and gazetted on the 9th July, 1867, dealt with the following subjects :—Alluvial prospecting in creeks and gullies ; extent of claims in new creeks and gullies.

Bye-laws passed on the 23rd July, 1867, and gazetted on the 23rd August, 1867, cancelled all previous bye-laws, and re-enacted the clauses with amendments. In addition, they dealt with the following subjects :—Claims in banks and beds of rivers ; plurality of claims ; defining and altering claims ; for limiting the time, &c. ; for determining whether and under what circumstances any person who shall have obtained an adjudication of any forfeiture of any land, claim, &c., can obtain possession ; relinquished, abandoned, or deserted claims ; for the purpose of regulating the drainage of quartz reefs, and of claims occupied under any bye-law of a mining board heretofore or hereafter to be made, and of lands held under gold mining or mineral leases heretofore or hereafter to be granted ; drainage of other claims ; for regulating the construction and strength of embankments, dams, &c. ; prevention of nuisances ; prevention of injury from baling water ; compensation for encouragement on certain Crown lands ; stacking auriferous substances ; regulations for claimholders on new rushes in shallow sinking ; for the division of Maldon, Fryer's Creek, and St. Andrews.

Bye-law passed on the 11th February, 1868, and gazetted on the 3rd March, 1868, dealt with the following subject :—Water in old shafts and workings, Maldon Division.

ARARAT DISTRICT.

Bye-law passed on the 25th March, 1858, and gazetted on the 13th April, 1858, dealt with the following subject :—No. 1, relating to block claims in wet sinkings.

Bye-laws passed on the 19th May, 1858, and gazetted on the 8th June, 1858, dealt with the following subjects :—No. 2, block claims in wet sinkings ; 3, frontage leads ; 4, amalgamation of claims ; 5, mining partnerships.

Bye-law passed on the 30th June, 1858, and gazetted on the 6th August, 1858, dealt with the following subject :—No. 6, quartz mining.

Bye-law passed on the 1st July, 1858, and gazetted on the 6th August, 1858, dealt with the following subject :—No. 7, prospecting.

Bye-laws passed on the 25th August, 1858, and gazetted on the 3rd September, 1858, dealt with the following subjects :—No. 8, sinkings on old workings ; 9, public holidays ; 10, annulling local court rules.

Bye-laws passed on the 11th October, 1858, and gazetted on the 26th October, 1858, dealt with the following subject :—No. 11, occupation of sites under a business license and a miner's right.

Bye-law passed on the 12th October, 1858, and gazetted on the 26th October, 1858, dealt with the following subject :—No. 12—*Bye-law relating to the occupation of dams, water privileges, &c.*—Form of application for a dam or other water privilege ; mode of making objections to the granting of water privileges ; objections proved to be valid, application not granted ; a grant shall constitute title ; ground occupied by a dam, &c., being auriferous, or preventing adjacent mining operations, to be drained ; compensation to owners ; dam, &c., in preparation, how forfeited ; construction of

dam and tail-race, and injury to property by dams; extent of puddling dam; sludge, refuse water, &c., to be embanked or carried off; dam abandoned, forfeited; penalty for defiling or carting away water from a dam; extent of dam for puddling without machinery; waterholes reserved; monopoly of springs not allowable; special grants of greater extent of dams, &c., on recommendation of mining board; dams and water privileges subject to certain fees.

Bye-laws passed on the 9th November, 1858, and gazetted on the 19th November, 1858, made the following addition to bye-law No. 6, relating to prospecting:—Cancelled clause 7 of bye-law No. 7; and made additions to the bye-law relating to block-claims in wet sinkings. They also, in addition, dealt with the following subjects:—*Water rights and privileges for sluicing purposes*—Extent of hill and surfacing claims for sluicing purposes; extent of claims in gullies; size of extended claims; claims to be marked by pegs; registration of claims; protection to claims during work; protection to claims during drought; forfeiture of claim; responsible parties; granting water-rights; notice of application for water-rights; gauge; priority of rights; protection to races during drought; protection to tail-races; distance between races; damage to races; keeping races in repair and making bridges; abandoned races; heads of races not to be shifted; construction of dams, &c.; tail-water.

Bye-law passed on the 26th November, 1858, and gazetted on the 7th December, 1858, dealt with the following subjects regulating mining operations in the Raglan Division of the Ararat District:—No. 1, classification of workings; 2, definition of lead; 3, frontage claims; 4, position of claims (frontage) when the lead deviates; 5, walls to be left; 6, to prevent shepherding; 7, giving notice on striking the lead; 8, oversized claims; 9, wet workings—size of claims; 10, water-baling and night-work; 11, suspension of day and night work, water-baling, &c.; 12, machinery; 13, drawing slabs; 14, dry workings—size of claims in flats and gullies; 15, hill surfacing—size of claims; 16, hill sinking—size of claims; 17, quartz mining—size of claims; 18, old workings—size of claims; 19, prospecting—size of claims; 20, hill surfacing—marking claims; 21, wet workings—marking claims; 22, shafts to be sunk in dry workings; 23, prospectors must report discoveries; 24, unsuccessful prospectors; 25, sinking in advance of a lead and discovering a lost lead; 26, puddling machines and dams; 27, ownership of shares; 28, sale or transfer of shares; bye-laws which are to have force in Raglan Division.

Bye-laws passed on the 17th December, 1858, and gazetted on the 29th December, 1858, amended clause 12 of bye-law No. 13.

Bye-law passed on the 9th March, 1859, and gazetted on the 18th March, 1859, enacted the order of proceedings of the Mining Board of Ararat, and the order of debate.

Bye-laws passed on the 12th April, 1859, and gazetted on the 3rd May, 1859, cancelled previous bye-laws relating to prospecting and to dry sinkings, and re-enacted them with amendments applicable to the Ararat and Pleasant Creek Divisions. They also cancelled portions of bye-law relating to quartz, and re-enacted the clauses with amendments; and amended certain clauses in the bye-law regulating mining operations in the Raglan Division.

Bye-law passed on the 12th April, 1859, and gazetted on the 3rd May, 1859, dealt with the following subject:—*Quantity and form of land which may be occupied by and for machinery*—No. 1, quartz crushing machines—size of claims; 2, where artificial reservoirs are required—size of claim; 3, notice of application—ground applied for; 4, objections to the application to be in writing; 5, protection to crushing

claimholders; 6, claimholders to commence work within reasonable time; 7, conditions of bye-law not observed, claim forfeited; 8, lead of gold traced to boundaries of crushing claims may be worked as in ordinary claims.

Bye-law passed on the 13th June, 1859, and gazetted on the 30th June, 1859, cancelled clause 1 of bye-law No. 5.

Bye-law passed on the 14th June, 1859, and gazetted on the 30th June, 1859, dealt with the following subjects:—*Intermediate mining in the Ararat and Pleasant Creek Divisions*—No. 1, interpretation clause; 2, size of intermediate claims; 3, marking out claims; 4, neutral ground; 5 to 7, forfeiture of claims; 8, forfeiture of slabs; 9, value of slabs to the owners; 10, removal of slabs; 11, injury to claims by not baling; 12, injury to claims by removing the earth from the top of shaft; 13, injury to claims by cutting a drain into the shaft; 14, absence from claim; 15, authority from warden to occupy forfeited claim; 16, repeal of bye-law No. 14—intermediate wet sinkings.

Bye-laws passed on the 12th July, 1859, and gazetted on the 26th July, 1859, enacted as follows:—Repealed portion of bye-law 4, and re-enacted the clauses with amendments; extended the operations of certain bye-laws of the Ararat Mining District to the division of Raglan in said district, and regulated the size of claims in quartz prospecting in the division of Raglan.

Bye-law passed on the 14th September, 1859, and gazetted on the 7th October, 1859, cancelled certain bye-laws as far as they related to the Pleasant Creek Division, and re-enacted them with amendments.

Bye-law passed on the 6th December, 1859, and gazetted on the 13th December, 1859, added the following to previous bye-laws regulating water-rights and privileges for sluicing purposes:—Amalgamation; hired labor.

Bye-law passed on the 7th December, 1859, and gazetted on the 27th December, 1859, cancelled previous bye-laws relating to quartz mining, and re-enacted the clauses with amendments.

Bye-law passed on the 8th December, 1859, and gazetted on the 3rd January, 1860, cancelled certain bye-laws, and re-enacted the clauses with amendments.

Bye-laws passed on the 17th January, 1860, and gazetted on the 3rd February, 1860, cancelled previous bye-law relating to sites occupied by crushing machines, and re-enacted the clauses with amendments. In addition, it dealt with the following subjects:—Duties of surveyor; deputy registrars; registration books; and repealed previous scale of fees, and amended it.

Bye-law passed on the 7th March, 1860, and gazetted on the 27th March, 1860, cancelled previous bye-laws regulating alluvial mining in the Ararat Division, and re-enacted the clauses with amendments.

Bye-law passed on the 15th May, 1860, and gazetted on the 30th November, 1860, dealt with the following subject:—Protection to stacked cement, tailings, &c.

Bye-law passed on the 15th May, 1860, and gazetted on the 30th November, 1860, cancelled previous bye-laws with certain exceptions, relating to alluvial mining in the Pleasant Creek Division, and re-enacted the clauses with amendments.

Bye-law passed on the 10th July, 1860, and gazetted on the 28th September, 1860, cancelled previous bye-law relating to quartz mining and re-enacted the clauses, and in addition it dealt with the following subjects:—Machinery claims; accident to machinery; protection to mortgagees; deceased partners; sludge; roads to be bridged; site proving auriferous; forfeiture of claims of special value; other cases of forfeiture; effacing notices or removing pegs.

Bye-law passed on the 12th December, 1860, and gazetted on the 11th January, 1861, dealt with the following subject:—*Wet sinking block claims*—Steam-power.

Bye-law passed on the 30th January, 1861, and gazetted on the 15th February, 1861, cancelled portions of previous bye-laws regulating mining operations in the Raglan Division, and relating to machinery in wet sinkings, and re-enacted the clauses with amendments.

Bye-law passed on the 10th April, 1861, and gazetted on the 23rd April, 1861, dealt with the following subject:—Shepherding.

Bye-law passed on the 10th April, 1861, and gazetted on the 30th April, 1861, cancelled previous bye-laws in force in the Raglan Division, with certain exceptions, and re-enacted the clauses with amendments.

Bye-law passed on the 12th September, 1861, and gazetted on the 1st October, 1861, cancelled all previous bye-laws in force in the Ararat Division relating to alluvial mining, and re-enacted the clauses with amendments. In addition it dealt with the following subjects:—*Steam machinery*—To encourage the introduction of steam-power and associated mining; owner of machinery may take possession of abandoned claim; mode of working and time for commencing work upon claims. *Water rights and privileges for sluicing purposes*—Extent of hill and surfacing claims for sluicing purposes; extent of claims in gullies; size of extended claims; claims to be marked by pegs; registration of claims; protection to claims during work; protection to claims during drought; forfeiture of claim; responsible parties; notice of intention to take up a water right; gauge; priority of rights; protection of races during drought; protection to tail races; distance between races; damage to races; keeping races in repair and making bridges; abandoned races; heads of races may be shifted; construction of dams, &c.; tail water; amalgamation; hired labor; non-forfeiture of claims through neglect of hired workmen; extended claims must be registered; plurality of shares; protection to claimholders employed, but not on claim; persons leaving the district must appoint an agent; agreements among shareholders; rights of holders under previous bye-laws.

Bye-law passed on the 12th September, 1861, and gazetted on the 8th October, 1861, dealt with the following subjects:—*Puddling machines and dams in the Raglan Division*—Size of claims; protection to claims; protection to claims during drought; distance between dams.

Bye-law passed on the 18th December, 1861, and gazetted on the 21st February, 1862, enacted bye-law for determining the validity of disputed elections.

Bye-law passed on the 13th January, 1862, and gazetted on the 21st February, 1862, enacted a bye-law regulating and enforcing the drainage of claims in the Ararat Division.

Bye-laws passed on the 13th January, 1862, and gazetted on the 21st February, 1862, dealt with the following subjects:—*Quartz mining*—Extent of tunnelling prospecting claims. *Alluvial mining, Ararat Division*—Prospecting; wet sinking, block claims; frontage leads.

Bye-law passed on the 21st July, 1862, and gazetted on the 22nd August, 1862, dealt with the following subject:—Appointment of managers for the goldfields commons in the Ararat Mining District.

Bye-law passed on the 25th August, 1862, and gazetted on the 5th September, 1862, cancelled the previous bye-law regulating the appointment of managers for the goldfields commons in the Ararat Mining District, and re-enacted the clauses with amendments.

Bye-law passed on the 6th October, 1862, and gazetted on the 2nd December, 1862, cancelled bye-law relating to alluvial mining, passed on the 13th January, 1860, and in addition dealt with the following subjects:—*Ararat Division*—Sinking in advance of a lead; wet sinking, block claims. *Frontage leads*—Marking off claims. *Wet sinking where rock occurs*—Where rock occurs in the sinking below the water-level; where rock does not occur in sinking.

Bye-law passed on the 17th November, 1862, and gazetted on the 28th November, 1862, dealt with the following subject:—Size of claims for steam puddling in the Raglan Division.

Bye-law passed on the 17th November, 1862, and gazetted on the 6th January, 1863, cancelled previous bye-laws relating to alluvial mining in the Pleasant Creek and Barkly Divisions, and re-enacted the clauses. In addition it dealt with the following subjects:—*Frontage leads*—Declaration of frontage leads; existing rights; size of claims; marking off claims; numbering of claims; registration of claims and shares; transfers; forfeiture of claims; claims may be amalgamated; giving notice on striking the lead.

Bye-law passed on the 10th December, 1862, and gazetted on the 6th January, 1863, cancelled portions of bye-law relating to the width of alluvial prospecting and frontage claims in the Ararat Division, and re-enacted the clauses with amendments.

Bye-law passed on the 10th March, 1863, and gazetted on the 24th March, 1863, cancelled portions of bye-law regulating alluvial mining in the Pleasant Creek and Barkly Divisions, and re-enacted the clauses with amendments.

Bye-law passed on the 3rd September, 1863, and gazetted on the 22nd September, 1863, cancelled previous bye-law regulating quartz mining, and re-enacted the clauses, with certain exceptions, with amendments. In addition it dealt with the following subjects:—Non-forfeiture through neglect of hired workmen; effacing notices or removing posts; plurality of shares.

Bye-law passed on the 8th October, 1863, and gazetted on the 23rd October, 1863, cancelled previous bye-laws relating to alluvial mining in the Ararat Division, and re-enacted the clauses with certain exceptions. In addition it dealt with the following subjects:—*Extended block claims*—Extended block claims; size of claims; mode of taking possession; registration; main drive to be constructed; method of laying off claims; marking of claims; mode of working; liability of shareholders; appointment of agent; abandonment of shares; abandonment of claim.

Bye-law passed on the 15th December, 1863, and gazetted on the 29th December, 1863, cancelled certain portions of bye-laws regulating alluvial mining in the Pleasant Creek and Barkly Divisions, and re-enacted them with the exception of the clauses relating to frontage leads.

Bye-law passed on the 4th May, 1864, and gazetted on the 13th May, 1864, cancelled certain portions of bye-law regulating alluvial working in the Raglan Division, and re-enacted the clauses with amendments.

Bye-law passed on the 21st June, 1864, and gazetted on the 5th July, 1864, cancelled previous bye-law regulating quartz mining, and re-enacted the clauses with amendments.

Bye-law passed on the 13th September, 1864, and gazetted on the 30th September, 1864, cancelled previous bye-law relating to occupation of sites under business licenses and miners' rights, and re-enacted it with amendments.

Bye-law passed on the 25th October, 1864, and gazetted on the 9th December, 1864, cancelled previous bye-laws regulating alluvial mining in the Pleasant Creek and Barkly Divisions, and re-enacted the clauses with amendments.

Bye-law passed on the 10th January, 1865, and gazetted on the 20th January, 1865, dealt with the following subject:—Appointment of managers for the united borough and goldfields common of Ararat.

Bye-law passed on the 19th April, 1865, and gazetted on the 5th May, 1865, cancelled portions of bye-law regulating alluvial mining in the Ararat Division, and re-enacted the clauses, and in addition it provided for the amalgamation of claims.

Bye-law passed on the 16th October, 1865, and gazetted on the 3rd November, 1865, cancelled previous bye-laws regulating wet alluvial workings in the Raglan Division, and with certain exceptions re-enacted the clauses. In addition it dealt with the following subjects:—Registration; mode of working; abandonment of claims; suspension of work; non-forfeiture through neglect of hired workman; work in connection with claim to be deemed working such claim; plurality of shares; liability of shareholders; abandonment of shares; duties of mining registrars; deputy registrars; fees to be paid to mining registrar.

Bye-law passed on the 28th January, 1867, and gazetted on the 22nd February, 1867, cancelled previous bye-laws regulating alluvial mining in the Ararat, Pleasant Creek, and Barkly Divisions; bye-law regulating quartz mining; bye-law regulating the occupation of sites under business licenses and miners' rights; and the bye-law regulating and enforcing the drainage of claims, and re-enacted the clauses, with certain exceptions, with amendments. In addition, it dealt with the following subjects:—Alluvial prospecting claims shall be registered; sinking ahead on a lead in dry sinking; sinking ahead on a lead in wet sinking; injury to claims by not baling. *Extended block claims*—Notice to registrar; efficient mining; abandonment of claim. *General regulations*—Definition of claim; protection to mortgagees; exempted lands. *Sites occupied by crushing machines*—Claimholders to commence work within a reasonable time. *Quartz bye-law*—Quartz reefs in alluvial claims; exempted lands; claims dependent on machinery; protection to mortgagees; insolvency, &c.

Bye-law passed on the 24th April, 1867, and gazetted on the 7th May, 1867, amended bye-law of 28th January, 1867, and determined what portion thereof shall apply to the Raglan Division.

Bye-law passed on the 12th November, 1867, and gazetted on the 31st January, 1868, dealt with the following subject:—*Alluvial mining in a part of the Ararat Division*—Extent of claim; mode of taking possession; registration; mode of working; efficient mining; amalgamation; rights of holders under previous bye-laws; protection to claimholders; effacing notices or removing pegs.

Bye-law passed on the 12th November, 1867, and gazetted on the 20th March, 1868, enacted the following clause:—To remove doubts as to the legality of titles to mining property.

Bye-law passed on the 27th April, 1868, and gazetted on the 7th July, 1868, cancelled the bye-law regulating quartz mining and re-enacted the clauses with amendments, and dealt, in addition, with the subject of roads across claims.

Bye-law passed 25th August, 1868, and gazetted on the 22nd September, 1868, amended bye-law No. 2.

GIPPSLAND DISTRICT.

Bye-law passed on the 5th March, 1867, and gazetted on the 22nd March, 1867, enacted that the Beechworth bye-laws of 1866 be in force in the Gippsland Mining District.

Bye-laws passed on the 5th March, 1867, and gazetted on the 17th May, 1867, dealt with the following subjects:—No. 1, repeal of existing bye-laws; 2, disputed elections; 3, standing orders; 4, ordinary quartz claims; 5, prospecting quartz claims; 6, union of quartz claims; 7, forfeiture of quartz claims; 8, abandonment of quartz claims; 9, alluvial ordinary claims; 10, ordinary river, creek, and bank sluicing claims; 11, bank sluicing claims; 12, prospecting, alluvial, river, creek, and bank sluicing claims; 13, union of alluvial, river, creek, and bank claims; 14, mode of taking possession of an alluvial, river, creek, and bank sluicing claim; 15, forfeiture of alluvial, river, creek, and bank sluicing claims; 16, abandonment of alluvial, river, creek, and bank sluicing claims; 17, general suspension; 18, exemption from forfeiture of claims; 19, water-races; 20, tail-races; 21, river and creek water rights; 22, how and where water to be gauged; 23, protection to springs; 24, causing claims to be flooded, prohibited; 25, protection to races and claims; 26, surveyor to enter upon claims; 27, who may enforce penalties; 28, worked or abandoned ground; 29, roads and tramways; 30, reservoirs; 31, residence and business sites; 32, sites for machinery; 33, fees for registration; 34, providing for non-appointment of surveyors or registrars; 35, absence from residence or business sites; 36, interpretation bye-law.

Bye-law passed on the 4th November, 1867, and gazetted on the 4th February, 1868, cancelled all previous bye-laws, and re-enacted them with amendments, and in addition dealt with the following subjects:—Level tunnel and adit rights; general provisions for races, drains, and tail-races; registration and transfer of shares; liens; shares in incorporated companies; commons.



APPENDIX E.

Rewards to Discoverers of Goldfields.

RETURN SHOWING THE NAMES OF ALL PERSONS TO WHOM REWARDS HAVE BEEN GIVEN FOR ALLEGED GOLD DISCOVERIES, SETTING FORTH THE AMOUNTS RECOMMENDED, DATES OF RECOMMENDATION, DATES OF PAYMENT, AND TO WHOM SUCH PAYMENTS WERE RESPECTIVELY MADE; ALSO AMOUNTS PAID TO GOVERNMENT PROSPECTORS.

Names.	Localities.	Date of Discovery.	Amounts Recommended.	Dates of Recommendation.	Amounts actually Paid.	Dates of Payment.	To whom Payments were made.
			£ s. d.		£ s. d.		
E. H. Hargreaves	—	—	5,000 0 0	10 Mar., 1854	2,381 0 0	27 Dec., 1855	J. Badcock.
W. B. Clarke	—	—	1,000 0 0	10 Mar., 1854	{ 476 4 0 523 16 0	5 Dec., 1855 7 Aug., 1861	J. H. Gregory. B. Alexander.
J. Hiscock	Ballaarat	Aug., 1851	1,000 0 0	10 Mar., 1854	{ 476 4 0 523 16 0	17 Jan., 1856 15 Jan., 1862	J. F. Strachan. J. F. Strachan.
J. W. Esmonds	—	1851	1,000 0 0	10 Mar., 1854	{ 476 4 0 523 16 0	17 Jan., 1856 22 June, 1861	J. F. Strachan. J. W. Esmonds.
L. J. Michel and party	Anderson's Creek	July, 1851	1,000 0 0	10 Mar., 1854	{ 476 4 0 523 16 0	29 Oct., 1855 5 July, 1861	L. J. Michel. L. J. Michel.
W. Campbell	Clunes	1851	1,000 0 0	10 Mar., 1854	476 4 0	10 Feb., 1857	W. Campbell.
G. H. Bruhn	—	April, 1851	500 0 0	10 Mar., 1854	{ 238 0 0 262 0 0	29 Nov., 1855 5 Oct., 1861	Kirchner, Sharp, and Co. R. Shann.
J. G. Mechook	Tarrangower and Kingower	June, Aug. 1853	1,000 0 0	31 July, 1857	{ 476 4 0 523 16 0	23 Sept., 1857 17 May, 1860	J. G. Mechook. J. G. Mechook.
W. McCrea	Hawthorne and Icy Creeks	1860	950 0 0	19 Aug., 1861	950 0 0	23 Aug., 1861	J. McCrea.
H. Mitchell and others	Wahgunyah	Sept., 1860	1,000 0 0	12 Nov., 1861	1,000 0 0	20 Mar., 1862	A. K. Shepard.
J. Parker, W. Hall, and others	Redbank, &c.	Dec., 1860	750 0 0	12 Nov., 1861	750 0 0	30 Dec., 1861	J. Parker.
J. Dunleary, T. Smith, and J. Henderson	Redbank	Jan., 1861	300 0 0	12 Nov., 1861	300 0 0	7 Jan., 1862	J. Dunleary, T. Smith, and J. Henderson.
J. Middlemiss and T. Berry	Mountain Creek, &c.	Dec., 1860	300 0 0	12 Nov., 1861	300 0 0	7 Jan., 1862	J. Middlemiss and T. Berry.
J. and J. Thomas	Mountain Creek	Nov., 1860	750 0 0	12 Nov., 1861	750 0 0	7 Jan., 1862	J. and J. Thomas
E. W. Gladman	Baw-Baw	Jan., 1860	250 0 0	12 Nov., 1861	250 0 0	28 Feb., 1862	E. W. Gladman.
Ellison and others	Londonderry	1860	250 0 0	12 Nov., 1861	250 0 0	2 June, 1862	J. Cannon.
J. Donnelly, De Crockett, and another	Donnelly's Creek	July, 1862	650 0 0	3 Dec., 1862	{ 216 13 4 216 13 4	21 Dec., 1863 16 April, 1863	J. Donnelly. De Crockett.
J. M. Connell and others	Walsh's Creek	Sept., 1862	200 0 0	3 Dec., 1862	200 0 0	21 Mar., 1863	W. Gooley, J. E. McCavey, J. Walsh, and J. M. Connell.
C. Donovan	Donovan's Creek	Oct., 1862	200 0 0	3 Dec., 1862	200 0 0	20 April, 1863	J. Sinclair.
W. Gooley	Gooley's Creek, Upper Goulburn	June, 1861	100 0 0	12 June, 1863	100 0 0	28 Sept., 1863	W. Gooley.

REWARDS TO DISCOVERERS OF GOLDFIELDS—continued.

Names.	Localities.	Date of Discovery.	Amounts Recommended.	Dates of Recommendation.	Amounts actually Paid.	Dates of Payment.	To whom Payments were made.
			£ s. d.		£ s. d.		
P. Geraghty -	Emerald, Nicholson, and Britannia	Dec., 1858	100 0 0	12 June, 1863	100 0 0	25 Sept., 1863	P. Geraghty.
M. O'Shanassy			100 0 0	12 June, 1863	100 0 0	29 Sept., 1863	M. O'Shanassy.
J. R. McAvoy			100 0 0	12 June, 1863	100 0 0	25 Sept., 1863	J. R. McAvoy.
J. Walsh -			100 0 0	12 June, 1863	100 0 0	8 Oct., 1863	J. Walsh.
W. McCrea -			100 0 0	12 June, 1863	100 0 0	14 Oct., 1863	W. D. Brown.
E. Hill -	Mount Blackwood	Feb., 1858	300 0 0	12 June, 1863	300 0 0	25 Sept., 1863	E. Hill.
J. Roach -			100 0 0	12 June, 1863	100 0 0	11 Nov., 1863	J. M. Saunders.
W. Potter -			100 0 0	12 June, 1863	100 0 0	14 Nov., 1863	W. Potter.
J. W. S. Slatter			100 0 0	12 June, 1863	100 0 0	11 Jan., 1864	J. W. S. Slatter.
J. Pollard -			100 0 0	12 June, 1863	100 0 0	5 Dec., 1863	J. Pollard.
H. C. P. Pollard	Ararat	June, 1854	100 0 0	12 June, 1863	100 0 0	2 Feb., 1864	H. C. P. Pollard.
P. F. Smith -			100 0 0	12 June, 1863			
J. Rodd -			100 0 0	12 June, 1863			
C. Upton -			100 0 0	12 June, 1863			
J. Edwards -			100 0 0	12 June, 1863			
C. Manby -	Inglewood	Nov., 1859	100 0 0	12 June, 1863			
H. C. Price -			100 0 0	12 June, 1863			
A. Thompson			200 0 0	12 June, 1863	200 0 0	14 Jan., 1864	R. Cahill.
J. Thompson			200 0 0	12 June, 1863	200 0 0	10 May, 1864	T. K. Johnston.
F. Thompson			200 0 0	12 June, 1863	200 0 0	10 May, 1864	T. K. Johnston.
J. Honey -	Emerald	Jan., 1859	200 0 0	12 June, 1863	200 0 0	2 Aug., 1864	R. Cahill.
P. O'Hannigan			100 0 0	12 June, 1863			
J. Law -			150 0 0	12 June, 1863	150 0 0	2 Dec., 1864	J. Law.
J. Frewster			150 0 0	12 June, 1863			
W. R. Marshall			150 0 0	12 June, 1863	150 0 0	21 Dec., 1863	W. R. Marshall.
G. Mills -	Alma	Dec., 1854	150 0 0	12 June, 1863	150 0 0	28 Dec., 1863	G. Mills.
W. Pierce -			150 0 0	12 June, 1863	150 0 0	14 Nov., 1863	W. Pierce.
G. Young -			150 0 0	12 June, 1863	150 0 0	16 Nov., 1863	T. Ritchie.
T. Potter -			100 0 0	12 June, 1863	100 0 0	26 Nov., 1863	H. Irvine.
H. Irvine -			100 0 0	12 June, 1863	100 0 0	26 Nov., 1863	H. Irvine.
S. McKean -	New Inglewood	Jan., 1860	100 0 0	12 June, 1863	100 0 0	26 Nov., 1863	H. Irvine.
D. Torquoy -			100 0 0	12 June, 1863	100 0 0	16 Oct., 1865	J. Omand.
J. Omand -			100 0 0	12 June, 1863	100 0 0	13 Feb., 1864	J. Omand.
P. Liddle -			100 0 0	12 June, 1863			
R. Miller -			100 0 0	12 June, 1863			
A. Franktovich	Redcastle	Dec., 1859	100 0 0	12 June, 1863	100 0 0	1 Aug., 1864	C. D. S. Pincock.
J. Jones -	Reedy Creek	1856	100 0 0	15 June, 1864	100 0 0	24 Oct., 1863	B. Danbank.
J. Egan -	Dayleford	Mar., 1852	100 0 0	15 June, 1864	100 0 0	26 April, 1866	J. O'Hara.
T. Connell			600 0 0	15 June, 1864	600 0 0	30 April, 1866	W. M. Alexander
W. Bulling -			200 0 0	15 June, 1864	200 0 0	8 May, 1866	T. J. Neilson.
H. T. Culling			400 0 0	15 June, 1864	400 0 0	24 April, 1866	A. S. Miller.
W. Adams -			100 0 0	15 June, 1864	100 0 0	6 July, 1866	J. Badcock.
R. Higgs -	Korong	May, 1852	100 0 0	15 June, 1864	100 0 0	25 June, 1866	J. Banks.
T. W. White			100 0 0	15 June, 1864	100 0 0	25 April, 1866	R. Higgs.
M. Johnstone			100 0 0	15 June, 1864	100 0 0	25 June, 1866	J. Banks.
W. Jewell -			100 0 0	15 June, 1864	100 0 0	25 May, 1866	M. Johnstone.
E. Windus -			100 0 0	15 June, 1864	100 0 0	30 April, 1866	W. Jewell.
J. Thomas -	Fiery Creek	Aug., 1854	100 0 0	15 June, 1864	100 0 0	1 May, 1866	E. Windus.
P. G. Emmett			100 0 0	15 June, 1864			
E. Rose -			58 6 8	15 June, 1864	58 6 8	28 April, 1866	T. B. Seljejt.
A. Lovell -			58 6 8	15 June, 1864	58 6 8	2 Jan., 1866	J. L. Butler.
C. D. Smith -			58 6 8	15 June, 1864	58 6 8	28 April, 1866	J. Emery.
	Elysian Flat	Nov., 1857	58 6 8	15 June, 1864	58 6 8	5 Dec., 1866	J. M. B. Gardgar, for manager of Colonial Bank, Wood's Point.
R. Jamieson			58 6 8	15 June, 1864	58 6 8	2 Jan., 1866	J. L. Butler.
W. T. Glover			58 6 8	15 June, 1864	58 6 8	28 April, 1866	J. Emery.

REWARDS TO DISCOVERERS OF GOLDFIELDS—continued.

Names.	Localities.	Date of Discovery.	Amounts Recommended.	Dates of Recommendation.	Amounts actually Paid.	Dates of Payment.	To whom Payments were made.
			£ s. d.		£ s. d.		
H. Swindells	Wardy Yallock	1852	100 0 0	15 June, 1864	100 0 0	7 July, 1866	J. H. Jenkins.
H. V. Smith and party			166 13 4	15 June, 1864			
T. Kemp and party			166 13 4	15 June, 1864	166 13 4	2 June, 1866	C. Dyte.
J. Hardy and party			166 13 4	15 June, 1864	166 13 4	2 June, 1866	C. Dyte.
W. Quinn	B B and Jordan	Dec., 1861	50 0 0	15 June, 1864	50 0 0	10 May, 1866	E. Fandlebury.
O. W. Little			50 0 0	15 June, 1864			
G. J. Jones			50 0 0	15 June, 1864	50 0 0	25 May, 1866	G. J. Jones.
P. Sandford			50 0 0	15 June, 1864			
T. T. Gaffney	Upper Goulburn	Jan., 1860	200 0 0	15 June, 1864	200 0 0	3 May, 1866	T. T. Gaffney.
D. Burn			100 0 0	15 June, 1864	100 0 0	3 May, 1866	J. Goodman, per A. Taylor.
G. Bell, senior	Avoca	Sept., 1853	100 0 0	15 June, 1864	100 0 0	28 May, 1866	G. Bell, senior.
G. Bell, junior			100 0 0	15 June, 1864	100 0 0	15 Oct., 1866	W. T. Paine.
J. Cox			100 0 0	15 June, 1864	100 0 0	13 July, 1866	W. T. Paine.
J. Worley	Mount Alexander	July, 1851	250 0 0	15 June, 1864	250 0 0	26 April, 1866	J. Worley.
C. T. Peters			250 0 0	15 June, 1864			
G. Robinson			250 0 0	15 June, 1864	250 0 0	26 April, 1866	G. Robinson.
R. Keen			250 0 0	15 June, 1864			
J. H. Conness	Indigo	May, 1858	500 0 0	15 June, 1864	500 0 0	24 April, 1866	J. Rosseter.
J. P. Main			150 0 0	15 June, 1864	150 0 0	12 Dec., 1865	J. Cowell.
J. Hogben			100 0 0	15 June, 1864	100 0 0	29 June, 1866	P. Main.
R. Omand			55 0 0	15 June, 1864	55 0 0	4 Jan., 1866	T. J. Everest.
J. T. Williams	Creswick	Sept., 1851	55 0 0	15 June, 1864	55 0 0	15 Sept., 1866	J. T. Williams.
P. Brannigan			55 0 0	15 June, 1864			
W. Lyons			55 0 0	15 June, 1864	55 0 0	11 Jan., 1866	W. Lyons.
W. Giles			55 0 0	15 June, 1864	55 0 0	12 Dec., 1866	C. Griffiths.
C. Tandy			55 0 0	15 June, 1864			
L. Lawrenson			55 0 0	15 June, 1864			
W. Leary			55 0 0	15 June, 1864	55 0 0	13 Jan., 1866	J. Harper.
Alfred Davis			55 0 0	15 June, 1864	55 0 0	30 Oct., 1866	A. Dairs.
John —			55 0 0	15 June, 1864			
M. de Graaf and L. Reitsma	Ararat Flat Lead, near Cathcart	May, 1864	200 0 0	4 Dec., 1865	200 0 0	9 Jan., 1866	M. de Graaf and L. Reitsma.
C. Brown	Darling Flat, near Rostrom's	Aug., 1864	400 0 0	4 Dec., 1865	80 0 0	10 Feb., 1866	T. Harsant.
T. Cole					80 0 0	25 June, 1866	T. Cole.
A. Mather					80 0 0	23 Jan., 1866	A. Mather.
R. Mather					80 0 0	23 Jan., 1866	R. Mather.
J. Cross	near Landsborough	Dec., 1864	200 0 0	4 Dec., 1865	80 0 0	23 Jan., 1866	J. Cross.
J. Burwood							
R. W. Davis					200 0 0	23 Jan., 1866	Burwood, Davis, and Carrie.
W. Carrie							
M. Coy	Coy's Reef, near Whroo	Sept., 1864	400 0 0	4 Dec., 1865	400 0 0	31 Jan., 1866	J. Brown.
G. Anderson							
J. O. Brian	Royal Standard Reef, Black River	Jan., 1865	500 0 0	12 July, 1866	250 0 0	27 Sept., 1866	F. C. C. Stander.
F. C. C. Stander					250 0 0	6 Oct., 1866	W. J. Singleton.
W. J. Singleton	Emu Flat	Oct., 1865	200 0 0	12 July, 1866	200 0 0	17 Sept., 1866	W. Logie and T. Jackson.
W. Logie and T. Jackson							
H. Hyam	Cherry-tree Flat	Feb., 1865	200 0 0	12 July, 1866	200 0 0	12 Sept., 1866	J. H. Gay.
E. Cameron	Cameron's Creek	Jan., 1866	30 0 0	29 July, 1867	30 0 0	9 Dec., 1868	P. Penny.
G. Withers			30 0 0	29 July, 1867	30 0 0	9 Dec., 1868	J. Ramage.
J. Bruce			30 0 0	29 July, 1867	30 0 0	9 Dec., 1868	J. Ramage.
J. Ray	Ray's Rush	Mar., 1866	75 0 0	29 July, 1867			
A. Jack			75 0 0	29 July, 1867			

REWARDS TO DISCOVERERS OF GOLDFIELDS—continued.

Names.	Localities.	Date of Discovery.	Amounts Recommended.	Dates of Recommendation.	Amounts actually Paid.	Dates of Payment.	To whom Payments were made.
			£ s. d.		£ s. d.		
R. Griffiths -	Shakspeare Hill, near Concongella Station	Dec., 1866	30 0 0	29 July, 1867			
A. Hatch -			30 0 0	29 July, 1867			
R. Wilson -			30 0 0	29 July, 1867			
A. McGregor	Alexandra -	June, 1866	75 0 0	23 Oct., 1867	75 0 0	17 Nov., 1868	F. Shiel.
A. K. Don -			75 0 0	23 Oct., 1867	75 0 0	24 Nov., 1868	A. K. Don.
R. Higgs -			50 0 0	6 Sept., 1867			
F. Steward -	St. Arnaud -	1855	50 0 0	6 Sept., 1867	50 0 0	26 Nov., 1868	F. Steward.
S. Scott -			50 0 0	6 Sept., 1867	50 0 0	26 Nov., 1868	S. Scott.
T. Wembridge			50 0 0	6 Sept., 1867	50 0 0	26 Nov., 1868	T. Wembridge.
R. Griffin -			50 0 0	6 Sept., 1867			
F. C. Dutton			50 0 0	6 Sept., 1867	50 0 0	20 Nov., 1868	F. C. Dutton.
D. Pilchard, <i>alias</i> Fultcher			50 0 0	6 Sept., 1867			
P. Tunstall -	Tunstall -	Jan., 1867	66 13 4	23 Oct., 1867	66 13 4	20 Nov., 1868	T. Crabbe.
J. Harper -			66 13 4	23 Oct., 1867	66 13 4	20 Nov., 1868	T. Crabbe.
C. Chapple -			66 13 4	23 Oct., 1867	66 13 4	20 Nov., 1868	T. Crabbe.
E. Jackson -			66 13 4	23 Oct., 1867	66 13 4	20 Nov., 1868	T. Crabbe.
C. Thompson			66 13 4	23 Oct., 1867	66 13 4	20 Nov., 1868	T. Crabbe.
S. Collins -			66 13 4	23 Oct., 1867	66 13 4	20 Nov., 1868	T. Crabbe.

Notes.—Of the amount of £650 awarded for the discovery of Donnelly's Creek Goldfield, the sum of £150 was an allowance for expenses incurred by the discoverers; and of the £950 awarded for the discovery of Hawthorne and Icy Creeks Goldfield, the sum of £200 was an allowance for stores, &c.

According to the Report of the Select Committee of the Legislative Council, on the claims for the discovery of gold in Victoria, dated 10th March, 1854, the amount of £5,000 recommended to be given to Mr. Hargreaves was for his discovery of gold in Australia; that to the Rev. W. B. Clarke (£1,000) for his researches into the mineral wealth of the country; that to Mr. Esmonds (£1,000) as the first actual producer of alluvial gold for the market; and that to Dr. Bruhn (£500) as an acknowledgment of his services in exploring the country, and diffusing the information of the discovery of gold in Victoria.

As far as this department has been able to ascertain, the only amount awarded or paid by the Government to Government prospectors, as a reward for the discovery of new goldfields, was the sum of £950 (£200 of which was an allowance for stores) to Mr. McCrea, for the discovery of Hawthorne and Icy Creeks.

Salaries and wages were paid, and rations, tools, &c., furnished, to prospecting parties under leaders chosen by the Board, as stated in the printed Report, dated 14th November, 1860, and laid before Parliament (Parliamentary Paper No. 12, of 1860-61). Other prospecting parties received assistance in the shape of rations and tools, and the amounts paid on account of each are given in schedules attached to the abovementioned "Report of the Prospecting Board."

Where the amounts are not inserted in the column "Amounts actually paid," the sums awarded are still unpaid.

The foregoing Return has been compiled from printed Parliamentary Papers, from returns supplied by other departments, and from other official documents in this office.

R. BROUGH SMYTH,

Secretary for Mines.

Office of Mines, Melbourne, 31st December, 1868.



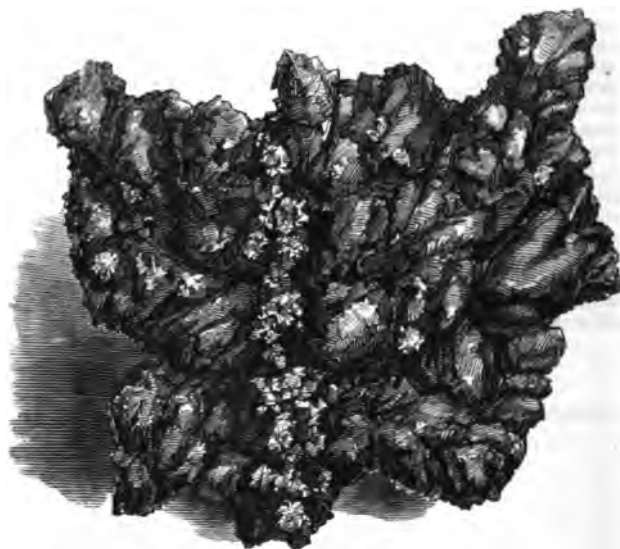
APPENDIX F.

Large Nugget found near Dunolly.



Attention has been already directed to the many large pieces of gold which have been found in the neighborhood of Dunolly; and, when the printing of this work was nearly completed, on the 5th February, 1869, there was unearthed by John Deason and Richard Oates a nugget weighing more than 2,280 ozs. 10 dwts. 14 grs. It was found on the extreme margin of a patch of auriferous alluvium trending from Bull-dog Reef. According to information furnished by Mr. Knox Orme, it appears that this mass of gold was lying within two feet of the bed-rock (sandstone), in a loose, gravelly loam, resting on stiff, red clay. It was barely covered with earth. It was about twenty-one inches in length and about ten inches in thickness; and, though mixed with quartz, the great body of it was solid gold.

FIG. 83.



THE "WELCOME STRANGER" NUGGET.

The accompanying drawing (Fig. 83) has been reduced from a large sketch made by Mr. Francis Fearn, which was certified by the discoverers as a fair representation of the nugget found by them.

Comparing it with a photograph of a sketch made from memory by Mr. Charles Webber, it would appear to represent not incorrectly the outward appearance of the "Welcome Stranger."

It is to be regretted that a cast or a photograph was not made, and the weight and specific gravity of it ascertained when it was first dug out of the ground. The discoverers appear to have heated it in the fire in their hut, in order to get rid of the quartz, and thus to reduce its weight before conveying it to the bank at Dunolly.

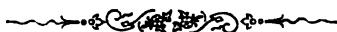
The melted gold obtained from it was 2,268 ozs. 10 dwts. 14 grs.; but a number of specimens and pieces of gold (weighing more than 1 lb.) were detached from it before it got into the hands of the bank manager; and what was broken off in the hut whilst it was on the fire, it is useless to guess.

Mr. Birkmyre says: "The gold of this nugget, from the crucible assays, I found to be 98.66 per cent. of pure gold. It thus contains only 1-75th of alloy, composed chiefly of silver and iron. The melted gold, with that given away to their friends by the fortunate finders, amounted to 2,280 ozs., or 2,248 ozs. of pure gold—its value at the Bank of England being £9,534."

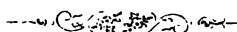
The neighborhood of Dunolly is almost unprospected country. For many miles there are out-cropping reefs which have yielded very large pieces of gold; and it is not at all improbable that other pieces of gold will be found as far exceeding the "Welcome Stranger" in weight and value as that nugget exceeds any yet recorded.

Near the spot where this mass was found there were unearthed two nuggets weighing respectively 114 ozs. and 36 ozs.

Very heavy gold is characteristic of this district; and large nuggets are found nearly every day.



A Glossary of Mining Terms.



ADIT—A horizontal gallery or drive, opening out either from some part of the slope or from the base of a hill or range into a mine, either for the purpose of drainage or ventilation, or for ordinary mining purposes. *See* TUNNEL.

AIR-STACK—A stack or chimney built over a shaft for ventilation.

ALLUVIAL—Characterizing soils and drifts deposited by aqueous agencies now or recently operative.

ALLUVION—**ALLUVIUM**—The soils, sands, quartz-drifts, clays, and auriferous gravels of recent formation found in the lines of watercourses, in flats, and on the slopes of hills in the (in some cases obliterated) lines of drainage, are called alluviums. The term is too often used vaguely.

AMALGAM—The compound of mercury with gold or silver.

AMALGAMATED CLAIM—Claims adjoining one another which have been thrown temporarily or permanently into one claim for more economical working.

AMALGAMATING BARREL—A common barrel, with an axle passing through the longer axis. It is charged, through a square hole in its side, with pyrites and other minerals caught by the blanket-tables, together with a proportionate quantity of quicksilver; and revolving, the quicksilver and minerals are brought into contact. Each barrel is generally cleaned out every forty-eight hours.

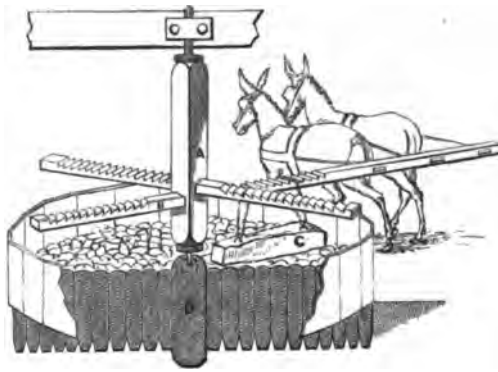
AMALGAMATION—The process of effecting the compound of mercury with gold or silver.

ARASTRA—**ARRASTRE**—A fixed round iron pan, about twelve feet in diameter, in the centre of which works a vertical axle, from which extend two or more arms; and fastened by chains to these arms are two or more blocks of granite. By the revolving of the axle the blocks of granite are drawn round the basin, grinding and reducing the tailings. Arastras are placed at the foot of ripple-board tables, from which they receive the tailings. There are numerous modifications of this machine. Those used in this country are generally constructed altogether of wrought and cast iron.

“The Mexican arrastre consists of a circular pavement of stone, about twelve feet in diameter, on which the quartz is ground by means of two or more large stones or mullers, dragged continually over its surface, either by horses or mules, but more frequently by the latter. The periphery of the circular pavement is surrounded by a rough kerbing of wood or flat stones, forming a kind of tub about two feet in depth, and in its centre is a stout wooden post, firmly bedded in the ground, and standing nearly level with the exterior kerbing. Working on an iron pivot in this central post is a strong upright wooden shaft, secured

at its upper extremity to a horizontal beam by another journal, which is often merely a prolongation of the shaft itself. This upright shaft is crossed at right angles by two strong pieces of wood, forming four arms, of which one is made sufficiently long to admit of attaching two mules for working the machine. The grinding is performed by four large blocks of hard stone—usually porphyry or granite—attached to the arms, either by chains or thongs of raw hide, in such a way that their edges, in the direction of their motion, are raised about an inch from the stone pavement, whilst the other side trails upon it. These stones each weigh from 300 lbs. to 400 lbs.; and in some arrastres two only are employed, in which case a single mule is sufficient to work the machine. The following woodcut (fig. 84.) is a sectional view of a Mexican arrastre as usually constructed, in which A is the upright shaft; B, arms to which mullers (C) are attached; and D, the central block of wood in which the lower bearing works.

FIG. 84.



The charge for an ordinary arrastre is 450 lbs. of quartz, previously broken into pieces of about the size of pigeons' eggs. The machine is now set in motion, a little water being from time to time added, and at the expiration of from

four to five hours the quartz has become reduced to a finely-divided state, and more water is added until the contents of the arrastre assume the consistency of tolerably thick cream. Quicksilver is then sprinkled over its surface to the amount of one ounce and a-quarter for every ounce of gold supposed to be contained in the finely-divided rock, which is generally known with a considerable degree of accuracy from the results obtained from previous charges. The grinding is after this continued for another two hours, during which time the mercury is divided into minute globules, and becomes disseminated throughout the mass, which should be of such a consistency as not to allow it to sink to the bottom, but be so held in suspension as to meet and amalgamate with all the particles of gold. At the expiration of this time the amalgamation is considered complete, and the process of settling the amalgam from the ground silicious matter is commenced. Water is now let into the paste so as to render it very thin and perfectly mobile, the mules being driven very slowly in order to allow the particles of gold and amalgam to yield to the influence of their densities, and to sink to the bottom. After having in this way slowly agitated the mixture for about half an hour, the thin mud is allowed to run off, leaving behind it, in the bottom of the arrastre, the gold combined with mercury in the form of amalgam. Another charge of broken quartz is now put in, and the operation is repeated, time after time, until it is thought desirable to stop for the purpose of cleaning up."—*J. Arthur Phillips.*

This account of the arrastre as used in the Californian mines is given here, because it is likely that it may be brought into use in the mountainous districts of the

colony, where rich reefs occur, and where it is almost impracticable to erect ordinary crushing machinery, except at an enormous cost. The loss of mercury in the common arrastre is great, but by dressing the stones and using a simple contrivance for arresting the heavier particles which flow from it, many of the disadvantages may be obviated.

ARCH—A structure usually of stone or brick, used in lieu of timber to support ground.

ATTLE—Refuse. *See* MULLOCK.

BACK—The upper portion of old quartz workings where the reef has been left unworked. The roof of a drive, stope, or the hanging-wall side of a reef. The ground between any level and the surface.

BACKING—A piece of timber laid across a drive near the roof, each end fitted into hitches cut in the rock, with slabs or laths placed between it and the roof.

BALANCE-BOB—The compensating weight attached to the beam of a pumping engine.

BANK-CLAIM—A claim which includes the bank of a river or creek.

BANK-RIGHT—The privilege of diverting water to a bank-claim.

BAR OF GROUND—A stratum differing in hardness or direction from the surrounding strata.

BASIN—The drainage area of a river, creek, or watercourse. An area within which the surface trends towards a common centre.

BATTERY—A group or set of stampers; or the whole of the stamp-heads collectively attached to an engine.

BAY OF BISCAY COUNTRY—*See* CRAB-HOLES. DEAD-MEN'S GRAVES.

BEARERS—Pieces of rectangular timber three or more feet longer than the length of the shaft, placed at the sides as foundations for sets of timber at certain intervals. Their ends are fixed in the solid rock. A set of bearers is comprised of from two to eight bearers resting on one another and is used to support and stay the pumping gear.

BED-CLAIM—A claim which includes the bed of a river or creek.

BED-ROCK—The strata on which the auriferous or lowest alluvial stratum lies.

BIFURCATED—**BIFURCATION**—Usually applied to a stream where it separates naturally into two channels, each having a separate course. It is never correctly applied to the junction of two streams.

BIT—The steeled point of a borer or drill.

BLACK SAND—Commonly applied to all the black and heavy minerals which usually accompany gold. Tin ore, titaniferous iron sand, magnetic iron, iserine, pleonaste, &c., &c., are generally called "black sand."

BLACK TIN—Black oxyd of tin.

BLANKET-STRAKE—*See* BLANKET-TABLE.

BLANKET-TABLE—An inclined plane or table covered with green baize and placed at the end of a ripple-board table to catch the fine gold, pyrites, &c.

BLAST—An explosion of gunpowder or guncotton in a bore-hole. Ignition of carburetted hydrogen. A shot.

BLAST-HOLES—Holes bored for the purpose of blasting. The perforations at the bottom of the *windbore* for admitting water to the pumps.

BLIND-CREEK—A line of drainage in which water flows only during very wet weather.

BLIND-SHAFT—*See* WINZE.

BLOCK-CLAIM—A claim bounded by right lines (except where in very rare cases a creek or river forms a boundary) which are fixed and defined by pegs, posts, or trenches at each angle of the claim; either at the time of taking possession, or within a prescribed time thereafter by survey, prior to registration.

BLOCKING-OUT—Working auriferous washdirt in blocks, in a manner somewhat similar to horizontal stoping.

BLUE-STONE—Basaltic rock. Sometimes wrongly applied to metamorphosed slate.

BOB-PIT—An excavation on the surface in which the balance-box attached to the pump-rods works.

BORE-HOLE—A hole bored for blasting. A vertical or horizontal hole bored for the purpose of ascertaining the character of the strata, or for tapping old workings filled with water.

BORER—*See* DRILL.

BOTTOM—The bed-rock. When a shaft reaches the bed-rock, the gold obtained from the bottom of the shaft is said to be the prospect from off the bottom.

BOTTOM-LIFT—The deepest column of pumps.

BOULDER—Any large mass of rock rounded by attrition. Often incorrectly applied to the "Tors" which are found on the summits and slopes of granitic ranges.

BOXING—A method of securing shafts solely by slabs. Auger holes are bored near the ends of the side slabs, and pegs are driven into them, and these pegs protrude an inch or more into the shaft. The end slabs are placed between the pegs and the ground, the pressure of which keeps the slabs in position.

BRACE—The mouth or collar of a shaft. *See* MAIN-BRACE.

BRATTICE—A wall of separation. Brattices are of two kinds; either permanent and separating a shaft into two or more divisions, or temporary and consisting of a framework of three-inch deal, readily moved to any part of the under ground workings. A wooden partition in drives to secure ventilation.

BREAK IN THE REEF—A fault. The cutting out of the quartz by a slide, or cross spur.

BREASTING—Timber used in levels driven in very soft ground, and placed across the drive behind the inside set of timber.

BRECCIA—Angular fragments composing a rock or vein. Fine brecciated rocks are found at Heathcote.

BUCKET MACHINE—*See* ELEVATOR-PUMP.

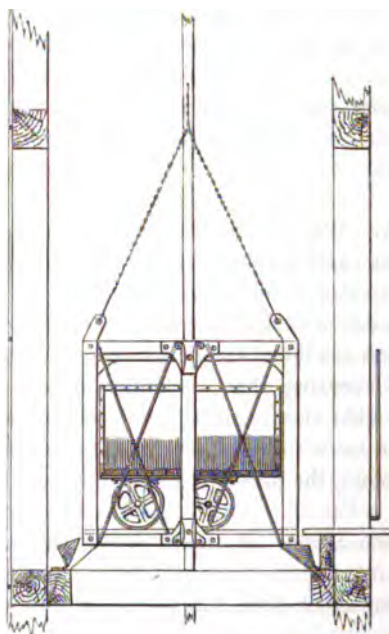
BUDDLES (CONCAVE AND CONVEX)—Machines somewhat similar in construction and use to puddling machines. They are used in alluvial mining for extracting gold from sludge, and in quartz mining for separating pyrites from tailings. The concave buddle (known as Munday's) is so constructed that the stuff to be treated is first received into a kind of trough on the outer edge, where it is subjected to the action of water, by which the refuse is carried off and discharged through an opening in the centre of the machine. The heavier and more valuable portion of the stuff is deposited on the bottom of the machine near the outer edge, whence it is removed by manual labor. An improvement upon this buddle has recently been patented by Mr. Lewis, of Clunes, and is said to be a great success. The chief points of difference between this buddle and Munday's is, that its bottom is a straight incline towards the centre instead of a curve, and it is fed so that the stuff shall fall on the bottom, about mid-way between the centre and the outer edge, while the water is delivered at the outer edge. By means of rakes the larger and heavier particles are drawn against the stream of water towards the outer edge, and lodged in a trough placed round the outer edge, from which they fall into pits. The lighter and finer particles are carried off by the action of the water through the opening in the centre of the machine; consequently Lewis's buddle does not require to be cleaned out. The concave (or old Cornish) buddle receives the stuff to be treated in the centre, and the lighter portion, or refuse, is carried towards

the outer edge, where the greater portion of it is discharged. This buddle, like Munday's, requires to be cleaned out.

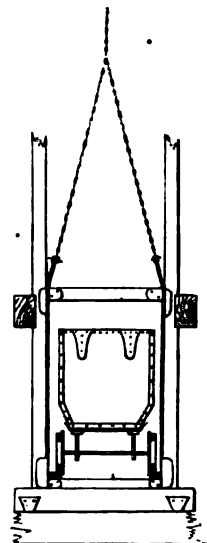
FIG. 85.

CAGE—A structure of iron and wood, in which tram-waggons are placed, to be raised or lowered in shafts, &c. Fig. 85 shows the side and end elevations of the cages used in the Catherine Reef United Mine, Sandhurst.

CAKE OF GOLD—Gold formed into a compact mass (though not melted) by the process of evaporating the mercury, or retorting by heat.



SIDE ELEVATION.

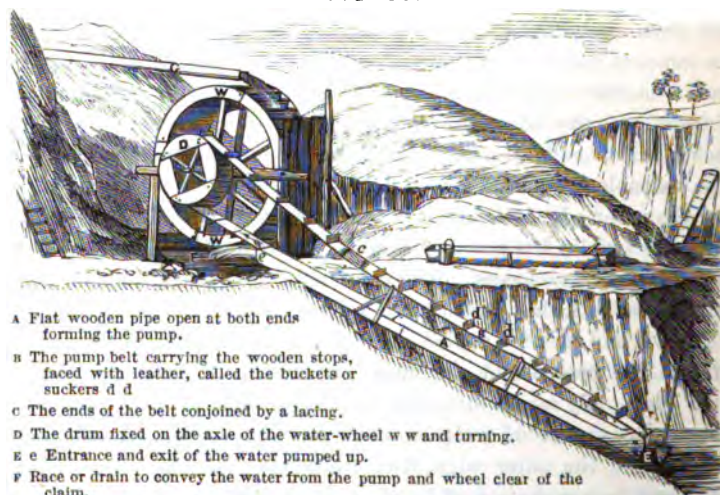


END ELEVATION.

CALCINING—Roasting or burning quartz, for the purpose of decomposing the pyrites, and driving off the sulphur, arsenic, and other substances which interfere with the process of amalgamation.

CALIFORNIAN PUMP—A rectangular box, about ten inches by three inches inside measurements, and from ten to thirty feet in length. Through it passes an

FIG. 86.



- a Flat wooden pipe open at both ends forming the pump.
- b The pump belt carrying the wooden stops, faced with leather, called the buckets or suckers d d.
- c The ends of the belt conjoined by a lacing.
- d The drum fixed on the axle of the water-wheel w w and turning.
- e Entrance and exit of the water pumped up.
- f Race or drain to convey the water from the pump and wheel clear of the claim.
- g A sluice-box set in the head race to bring the water over the wheel.

endless flexible band or belt, on one side of which are fastened discs or floats of wood, nearly as large as the inside of the tube or box. This pump is

worked by water, horse-power, or by manual labor, with the box placed in a diagonal position. Californian pumps are used only in shallow alluvial ground. Fig. 86 is a sketch of a Californian pump.

CAM—A curved tongue fixed on the cam shaft, which raises the stamp-head by catching the disc. It is fixed on to the stamp-lifter.

CAM-SHAFT—The revolving axle on which the cams are fixed to work the stamp-heads.

CAP—The upper portion, or saddle formation of a quartz reef; the piece of timber which is placed on and above the props in a drive; a crown-tree.

CAP-PIECE—The top transverse piece of a set of timber. It is used mainly for supporting the roofs of plats and drives. A crown tree.

CAPTAIN—The chief superintendent in a mine.

CARTRIDGE—A charge of powder contained in a case. It is used in both wet and dry ground. In wet ground, when the water is too powerful to be excluded from the hole by clay, and in dry when the bore-holes rise at such an angle that loose powder will not remain in the holes. The cartridge cases used in wet ground are made impervious to water.

CASING—A partition of planks dividing a shaft into parts. Sometimes applied to the lining of a shaft.

CASING OF A REEF—The abnormal vein stuff abutting on the solid reef.

CATCH-PIT—**TAILINGS-PIT**—An oblong hole sunk about eight or ten feet in the ground, and timbered after the manner of a shaft. It is used for catching and storing the water and tailings run off from a crushing machine.

CAVED IN—Undermined ground the roof of which has fallen, or the sides of which have collapsed, is said to have "caved-in."

CEMENT—Conglomerate; quartzite; quartz-gravel, with an argillaceous, silicious, or ferruginous cement; auriferous pudding stone.

CHAMBER—*See* PLAT.

CHARGE—The gunpowder or guncotton used in a blast.

CHINESE PUMP—(*Suey chae.*) A pump differing from the Californian only in its being made entirely of wood. The belt is composed of short pieces of wood hinged together by wooden pins.

CLACK—A pump valve.

CLAIM—A portion of ground marked off in accordance with the mining bye-laws of the district, and held by virtue of miners' rights.

CLAYING-BAR OR IRON—A tapering bar having a hole at the thickest end. It is used in wet ground. When a hole has been bored and water is found to gather in it, the hole is filled with moulded clay, and the *claying-bar* is then driven into it with a hammer; a piece of iron is put through the hole, and the bar is twisted round and drawn out. If there is not much pressure of water, it will be excluded from the hole by this means.

CLEANING-UP—*See* WASHING-OFF and PANNING-OFF.

CLEAVAGE—Rocks which split usually in thin plates or laminæ in planes, nearly always different from those of bedding, exhibit what is termed cleavage. The planes of cleavage rarely coincide with the planes of bedding.

COFFER (pronounced Kofer)—The cast-iron box in which the stamp-heads work.

COLLAR OF A SHAFT—*See* BRACE.

COLOR—When only very minute particles of gold are found in a "prospect" the miner is said to have got the "color."

COMPOUND CRADLE—A large cradle about seven feet in length by five feet in width. It has three tiers of slides or blanket-tables, and attached to it is a shaking table with a quicksilver ripple in it. There is also in some cases a small Berdan-basin connected with it.

CONGLOMERATE—Cemented gravels; pudding stone; cement; rounded, water-worn quartz-gravel, agglutinated by an argillaceous, silicious, or ferruginous cement. Differs from breccia, which is always composed of *angular* fragments of rock.

CONSOLIDATED MINER'S RIGHT.—See MINER'S RIGHT.

CO-OPERATIVE CLAIM—A claim in which the partners or owners are employed.

COPPER-PLATE—A sheet of copper coated with quicksilver, and nailed on to the foot of ripple-board tables, to catch the fine gold contained in the pulverized quartz passing over it.

CORD OF FIREWOOD—Measures 128 cubic feet, or more than two of the usual tons of firewood. It makes a pile eight feet long, four feet high, and four feet broad.

CORE—CORPS—A miner's day's work, equal to eight hours. A set of miners. Three corps work in the twenty-four hours.

COUNTRY—The strata on either side of a reef, or lode.

CRAB-HOLES—Holes often met with in the bed-rock in alluvial mining. They have the appearance of having been formed by eddies of water. Crab-holes on the surface are in general due to the unequal decomposition of the underlying rocks. After rains cray-fish are found in the muddy water and mud. In the basaltic plains, as well as in the palæozoic country, these holes occur, and are often the cause of serious accidents. See DEAD-MEN'S GRAVES—BAY OF BISCAY COUNTRY.

CRAB-WINCH—An iron machine consisting of two triangular uprights between which work two axles, one above the other. On the upper axle is a small cog-wheel near to one of the uprights, and at the ends of this axle are placed cranks or handles to which are applied the motive-power. On the lower axle is fixed a large cog wheel which fits into and is worked by the upper wheel. The remaining portion of this axle is occupied by a drum or barrel on which coils the chain or rope. These machines are frequently used in connection with pumping gear where engine shafts are not deep.

CRADLE—The common cradle is a wooden box from three to four feet in length, and one foot to one foot eight inches in width. It has a movable hopper and slide, and is fixed on two rockers. When it is in work it is placed on an inclined plane.

CREEK—The tributary of a river: a small stream of water. In Australia usually in dry weather a chain of water holes. A gully is a feeder of a creek; and a creek is a feeder of a river.

CREEK-CLAIM—A claim which includes the bed of a creek.

CREEK-RIGHT—The privilege of diverting water for the purpose of working a creek-claim.

CROSS-CUT—A level driven at right angles to the direction or course of the strata or reefs for prospecting, or for other mining purposes.

CROSS-SPUR—A vein of quartz which crosses the reef.

CROWN-TREE—See CAP and CAP-PIECE.

CRUSHING—The reduction of quartz by a crushing machine. Applied to undermined ground which is settling down for want of support.

CRUSHING MACHINE—An engine working stamping machinery for reducing quartz and similar to the Cornish stamping machine. The only important difference is

- that, in the crushing machine, the stampers in most machines revolve, whilst the Cornish stamps do not.
- CUTTING DOWN A SHAFT**—Increasing its size.
- DATUM WATER-LEVEL**—The level at which water was first struck in a shaft sunk on a reef or gutter.
- DEAD-MEN'S GRAVES**—Applied to country generally basaltic, where, owing to the unequal decomposition of the underlying rock, humps like graves occur.
- DEADWORK**—The opening up or preparatory work for mining by sinking shafts and winzes, driving levels and cross-cuts, the sinking or driving of which produces no quartz or reef stuff which yields gold.
- DERRICK**—*See WHIP.*
- DIGGER**—Commonly applied formerly to all persons who searched for gold; and now generally restricted to those who seek for gold in the shallow alluviums.
- DIP**—Underlie. The dip of the beds is always at right angles to the strike. The angle of dip is the angle at which strata lie to the plane of the horizon.
- DIRT**—*See WASHDIRT.*
- DISC**—The circular tongue which is fastened to the lifter of a revolving stamp-head. The cam attached to the cam-shaft catches the under surface of the *disc* at every revolution and lifts it.
- DIVIDE**—*See DIVIDING-RANGE.*
- DIVIDING-PIECE**—A piece of squared timber placed between the wall-plates of a set of timber. There may be one or more for each set, and so placed as to determine the size of the respective compartments of the shaft.
- DIVIDING-RANGE**—A range of hills or mountains or relatively elevated lands which separate creeks or rivers.
- DOLLY**—An instrument used by diggers for dividing and mixing the tough clay or cement with water in the puddling tub. A log of wood shod with iron and suspended from a sapling over a stump, and used in the early days for crushing quartz.
- DOOR-PIECE**—That portion of a lift of pumps in which the clack or valve is situate. Access to the valve is got by unscrewing the door.
- DOUBLE-BANK**—To take up a claim parallel with and adjoining another claim in which has been found an auriferous reef or lead; with the object of getting the underlie of the reef, or a bend in the lead or some portion of the washdirt. Working with double sets or relays of men.
- DRAINAGE-SHAFT**—*See ENGINE-SHAFT.*
- DRIFT**—A drive, level, or gallery. Loose sand or a very loose friable alluvial deposit met with in some places close to the washdirt; and, when so situated, very dangerous, requiring close timbering and great care in working.
- DRIFT-SLABS**—Slabs of greater length than ordinary. They are used specially in damming back drift and water from a shaft.
- DRILL**—An instrument used in boring holes for blasting purposes. A borer.
- DRIVE**—A level or gallery driven horizontally in the reef.
- DROPPER**—A spur dropping into the lode. A feeder.
- DROP-SHAFT**—A monkey-shaft, down which earth or other matter is lowered by means of a drop (*i.e.*, a kind of pulley with a break attached). The empty bucket or truck is brought up as the full one is lowered.
- DUCT-MACHINE**—An apparatus for forcing air into a mine. It consists of two boxes, each from four to ten feet long. One of the boxes (nearly filled with water) is

stationary, and the other is moveable; and, by a simple arrangement of valves, air is forced into the workings through pipes in the shaft.

DYKE—Applied to masses of intrusive rock occurring in a manner somewhat similar to veins. The dykes of syenitic diorite, at Wood's Point, are intersected by horizontal veins of quartz.

ELEVATOR PUMP—An endless band running over two drums; on this band are fixed, at short intervals, small iron or tin buckets. It is used for draining shallow alluvial claims, and is sometimes called a bucket machine.

ELVAN—Applied to a felspathic rock occurring in dykes.

END—The extremity of a level or drive.

ENGINE-SHAFT—The main shaft in which the pumps and pump-rods are fixed. It is sometimes called the water shaft, and the drainage shaft. Usually the deepest shaft in a mine.

EXEMPTED CLAIM—A claim allowed by the mining bye-laws to remain idle for a certain term, and for which an exemption certificate has been obtained from the mining registrar.

EXTENDED CLAIM—A block or frontage claim, the extent of which has been increased by the annexation to the original claim of an additional area of ground or length of lead, or by the amalgamation of one or more claims with the original claim.

FACE—The end of a drive. A perpendicular cutting of ground anywhere. The wall, cheek, or side, of a reef.

FALSE BOTTOM—A loose cast-iron bed-plate so placed, in the stamper-box, that the stamp-head shall beat on it. A *false bottom* in a puddling machine, is a bottom or floor of iron (or other material) placed inside the puddling machine, so as to lie flat upon the bottom of the machine, and to preserve it from injury. In some cases, a complete lining of boiler-plate iron is fitted into the machine, but those more recently made are of cast-iron, and cast in segments and fitted together so firmly and closely as not to need a *false bottom*. *False bottoms* in sluicing, formed of stout battens framed together and laid lengthways in the sluice, are occasionally used. There are also false bottoms, consisting of boards fitting inside the boxes, and bored with as many inch or inch and a-half holes as the wood will permit of. *False bottom* in alluvial mining is a stratum (of the same geological age as the accompanying drifts) whereon the auriferous *washdirt* rests. Below it are other auriferous strata resting on the true bottom (the upturned edges of palæozoic strata).

FALSE SET—In driving through old or very loose new ground a small set of timber is used to support the ground at the top and sides, until the drive is advanced far enough to admit of the larger and permanent sets of timber being fixed in their places. Then the *false* or small set is removed and again used in advance of the last permanent set.

FAN—A machine used for forcing air down a shaft or into a drive.

FAULT—A slip or trouble. Strata fissured and displaced, and reefs abruptly cut off and thrown up or down are said to be faulted.

FEEDER—A spur falling into a reef increasing or apparently increasing its size and richness.

FENCING IN A CLAIM—Making a drive round the boundaries of an alluvial claim to secure the washdirt from being worked out by adjoining claimholders.

- FLAT**—A low even tract of land, generally occurring where creeks unite, over which are spread many strata of sand and gravel, with the usual rich auriferous drift immediately overlying the bed-rock.
- FLAT-RODS**.—Horizontal pump-rods that run on stationary flanged wheels on the surface, or in a drive or level beneath it.
- FLAT-SHEET**—Sheet-iron flooring at the brace and in the plats and chambers and junction of drives to facilitate the turning and management of trucks.
- FLOATING REEF**—Applied often to masses of bed-rock which are found displaced and lying amongst the alluvial *detritus*. Detached portions of vein-stone occurring *in situ*.
- FLOOR**—A false bottom, with washdirt lying on it. Sometimes three or four of these floors are met with before the washdirt on the bed-rock is reached. The bottom of a drive. A seam or joint in a rock.
- FLOUR-GOLD**—The finest alluvial drift-gold. It is found in the deep lead at Huntly, coating quartz pebbles in cement.
- FLOURING**—When mercury is ground together with quartz containing sulphides (generally the sulphides of iron, antimony, or lead), the metal granulates, and each grain becomes coated with a film of sulphide. The power the mercury possesses in its normal state of attacking and amalgamating with gold, is thus lost; and hence we have the terms—often loosely applied—of “flouring” and “sickening.” Correctly speaking, “flouring” is the forming of the mercury into small particles by the action of the reducing-machine, and the subsequent coating of each particle by some sulphide, whereby the power of the particles to re-unite and to amalgamate with gold is lost. “Sickening” is due to the presence of some chemical compound, which prevents the mercury from taking up and amalgamating with the usual proportion of gold. Sodium-amalgam is said to prevent “flouring” and “sickening.” It is said that the atoms of quicksilver are put into a sort of polaric condition by a minute addition of one of the metals which range themselves towards the electro-positive end of the scale; so that the affinity of the quicksilver for the more electro-negative metals is so greatly exalted that it seizes upon, and is instantaneously absorbed by their surfaces.
- FLUCAN OR FLOOKAN**—A sort of clayey substance, often found against the walls of a quartz reef, and accompanying cross-spurs and slides.
- FLUME**—The more artificial portion of a race or tail-race, consisting of piping, hose, or wooden boxes let into each other. Usually applied to wooden troughs for conveying water.
- FOOTHOLE**—Holes cut in the sides of shafts or winzes to enable miners to ascend or descend them.
- FOOT-PIECE**—A wedge of wood or part of a slab placed against the footwall. Usually the lower end of a stull-piece rests, or rather, is jammed against it. It is sometimes placed on the floor of a drive to support the leg-piece or prop.
- FOOT-WALL**—The bounding rock beneath or on the lower side of a reef. If a reef underlies to the west the eastern side of the reef is the *foot-wall* side, and *vice versa*.
- FOOTWAY**—See LADDER-ROAD.
- FORK**—When a mine is in *fork* the bottom of the engine-shaft is clear of water. The word is sometimes applied to the place where two streams unite. An instrument used by puddlers and sluicers for mixing earth.

- FOSSICKER**—Is to the miner as is the gleaner to the reaper. Picks the crevices and pockets of the rocks.
- FRAME OF TIMBER**—Differs (as some say) from a "set" in width, and the legs are placed perpendicularly. They are usually from seven to ten feet in width. In quartz mining *frame of timber* is synonymous with *set of timber*, which see.
- FRONTAGE CLAIM**—A claim, the lateral boundaries of which are not fixed until the lead has been traced through it.
- FURNISHER**—A capitalist who by erecting machinery for, or otherwise assisting a party of miners working a claim, becomes entitled to a share of the profits.
- FUSE—FUZE**—A small cylindrical cord filled with powder or other combustible matter used for igniting the powder in a bore-hole.
- GAD**—A small steel wedge or tool used for dividing or separating rock.
- GASH-VEIN**—A wedge or V shaped vein.
- GEAR**—Appurtenances belonging to a machine.
- GEARING**—A series of wheels working into each other whereby motion is transmitted.
- GRASS**—The surface.
- GRATING**—A piece of thin sheet-iron, in which about 100 holes (more or less) to the square inch are punched. It is fixed in front of the stamper-box.
- GROUND-SILL**—Is that part of a drive-set of timber which is laid in the floor of a drive, on the ends of which rest the legs of the set.
- GROUND-SLUICE**—A channel cut in the bottom or bed-rock, into which the earth is conveyed by a stream of water. It is sometimes lined with sawn planks. False bottoms formed of stout battens, framed together and laid lengthwise in the sluice are occasionally used to protect the wooden bottom from the wearing action of the stones, &c., passing through the sluice. Some sluices are paved with large stones, and others are paved with blocks of wood, grain on end. Ground-sluices are employed where the bottom is sufficiently high to afford the necessary fall for the stuff passed through the sluice.
- GUIDES**—Are continuous lengths of squared timber, about six inches by three inches, which run down the centre of the drawing compartment of a shaft. The distance between each couple of *guides* is just sufficient to admit of a cage working up and down between them. The wings of the cage, of which there are four sets, two on each side, keep the cage travelling in the line of the *guides*.
- GULLY**—A watercourse; a line of drainage; a feeder of a creek.
- GUTTER**—The lowest portion of a lead. A *gutter* is filled with auriferous drift, or *washdirt*, which rests on the palæozoic bed-rock.
- GUTTER-FLAGS**—Flags fixed on the surface to denote where the course of a gutter or lead underground has been discovered.
- HALF-SET**—A half-set of timber for a drive consists of one leg-piece and a cap-piece, and is used where the ground is soft on one side only.
- HAND-WHIP, LEVER-WHIP**—Is composed of a rough post fixed vertically in the ground, to the upper end of which a long straight sapling is fastened at its centre. A bucket is attached by a rope to the thin end of the sapling, and a bag filled with gravel is tied on to the thick end. This bag acts as a balance to the full bucket. *Hand-whips* are employed in shallow alluvial mining, for raising the stuff to the surface. Trees situated close to the workings are often used as uprights.
- HANGING-WALL**—The strata on the back or upper side of a reef. If a reef underlies to the west, the bounding rock on the western side of the reef forms the *hanging-wall*.

- HARROW**—Somewhat similar to the harrow of the agriculturist. Harrows are fixed to the pole of a puddling machine, and being dragged round, divide and mix the auriferous clays with water.
- HATTER**—One who works alone. He differs from the fossicker, who rifles old workings, or spends his time in trying abandoned washdirt. The hatter leads an independent life, and nearly always holds a claim under the bye-laws.
- HEAD-BOARD**—A wedge of wood, or part of a slab, placed against the hanging-wall. One end of a stull-piece rests, or rather is jammed against the *head-board*.
- HEADINGS**—Coarse gravel or drift overlying the washdirt.
- HEAD-WALL**. See **HANGING-WALL**.
- HEAVY GOLD**—Gold in large particles. Sometimes called "shotty gold," when it has the appearance of gun-shot.
- HIGH-REEF**—The bed-rock, or reef, is frequently found to rise more abruptly on one side of a gutter than on the other, and this abrupt reef is termed the *high-reef*.
- HIGH-REEF WASH**—This term is usually applied to deposits of washdirt upon the high-reef.
- HOE**—An agricultural implement much used on the goldfields for separating the dirt washed in long-toms.
- HOLE**—A small shaft sunk in shallow alluvial deposits, or gullies. A bore for the purpose of blasting.
- HONEYCOMBED**—Basalt, or any rock which contains many cavities, is said to be *honey-combed*.
- HOOK-HANDLE**—The handle of a windlass, and generally made of iron. Wooden handles cut from boughs of trees, and naturally formed with the requisite curvature, are sometimes used; wattle is preferred.
- HOPPER**—The square wooden frame fitted on the top of a cradle. The bottom of it is made of iron, and perforated, the holes being about a quarter of an inch in diameter. A wooden framework, which receives quartz that is to be crushed, and so placed as to deliver the quartz into the stamper-box.
- HOPPERINGS**—Gravel caught by the hopper in cradling operations.
- HORSE OF GROUND**—The intrusion of a portion of the strata adjoining a reef into it; or the inclosure of a large body of slate or sandstone in the quartz of a reef.
- HORSE PUDDLING MACHINE**—See **PUDDLING MACHINE**.
- HORSE-PUMP**—An ordinary lifting pump worked by horse-power.
- HYDRAULIC HOSE**—A common hose used in gold-washing for conveying water to alluvial claims, where by the fall and pressure of the water the *detritus* is broken down and washed. The canvas hose used in California and other countries for hydraulic mining, is usually covered with iron rings or close cord netting, and the pressure such a structure bears is very considerable. With a large volume of water, vast quantities of *detritus* and gravel can be removed with little manual labor. A pressure of from 60 lbs. to 100 lbs. to the square inch is common. Only where the fall is considerable, and water abundant, can hydraulic mining be profitably pursued.
- IRONSTONE CASING**—The ferruginous casing which abuts on a quartz reef. It is usually auriferous.
- JEWELLERS'-SHOP**.—A claim in which occur patches of extraordinary richness.
- JUMPER**—An instrument used in boring holes in blasting operations. One who seeks to get possession of a claim or a mining interest by dishonesty or trickery.
- JUMP-UP**—A short winze dug in the roof of a drive. A rise. See **MONKEY-SHAFT**.

KAOLIN—The clay derived from the decomposition of the felspar of granites. It is found more or less pure in all the granitic districts where the granite has decomposed *in situ*. Some of the clays resulting from the decomposition of the older basalts much resemble kaolin in appearance, but their mineral constituents and properties are different.

KIBBLE—See WHIM-BUCKET.

KILN—A place prepared for the calcining of quartz. A kiln of quartz is sometimes rudely stacked on a layer of logs and brushwood, and there roasted.

KINDLY QUARTZ—Quartz having the appearance of that which usually contains gold.

KNOCKER—A hammer fixed near the mouth of a shaft, and which may be moved by pulling a line hanging down the shaft. It is used as a medium of communication between men underground and those at the surface.

LADDER-ROAD—The connection of ladders by which miners travel to and from the underground workings of a mine.

LATHS—See SLABS.

LAUNDER—A flume or aqueduct. A trough into which falls the crushed quartz after it passes the battery and tables. A spout through which a buddle is fed.

LAVA-STREAK—A dyke. Often applied incorrectly to the layers of black schist and alum-slate, which quartz veins intersect in some places.

LEAD—A deep alluvial auriferous deposit or gutter. A lead, correctly defined, is an auriferous gully or creek, or river, the course of which cannot be determined by the trend of the surface, in consequence of the drainage having been altered either by the eruption of basalt or lava, or the deposition of newer layers of sand and gravel.

LEADER OF QUARTZ—Usually applied to small veins of quartz, which when followed are found to unite with the main lode.

LEG-PIECE—An upright log or prop, one end of which is fixed either in the floor of a drive or on a ground-sill, or sole plate, and on the other is fitted one end of a cap-piece. Leg-pieces are placed against the sides of drives.

LEVEL—See DRIVE.

LIFTER—A long iron bar fixed into the centre of a stamp-head, on which is fastened a disc or tongue. The cam from the stamp-axle catches, in its revolutions, this tongue and lifts the head.

LIFT OF PUMPS—A series of hollow cylinders, consisting of a wind-bore or suction pipe, immersed in the water in the bottom of the shaft,—a door or clack-piece, in which the stationary valve is fixed; a working barrel, in which the pump-bucket works; and a column of ordinary pumps, reaching either to the cistern from which the next *lift* takes its water, or to the surface. The bore of the suction-pipe and the pumps is of the same size, but the bore of the working barrel is one inch less.

LIGNITE—Fossil wood. Wood coal. Applied to those deposits of leaves, wood, and resin which occur in recent formations.

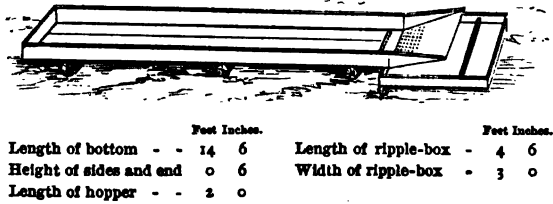
LOB OF GOLD—A very large quantity or rich deposit of gold contained within a small area, sometimes called a pile of gold.

LODE—A quartz reef. A mineral vein.

LOGS—Trunks of trees. Portions of the trunks of trees cut into lengths, and so placed as to raise the mouth or collar of a shaft from the surface, in order to give the requisite space for the lodgment of mullock and vein stuff.

LONG-TOM—A gold washing machine or table about twenty-four feet in length, two feet in width, and with sides twelve inches in height. The bottom is lined with sheet-iron one-eighth of an inch in thickness. The table rests on logs of wood laid on the ground, which give it a slight fall. The washdirt is thrown into the table at its head (near the mouth of the pump, which supplies it with water), and it is mixed with water by forks and gradually washed down to the hopper, through which the finer portion passes on to the ripple-board, where the gold is caught by the ripples and blankets; the coarser gravel, which will not pass through the hopper, is cast away. Fig. 87 is a sketch of a long-tom and ripple-box.

FIG. 87.



MACHINE—A general name for machinery employed in mining; such as pumping, crushing, winding, and puddling machines. "Machine" is often applied to the quantity of washdirt which is put through a horse or steam puddling machine, and the resulting quantity of gold is stated as per "machine."

MADE-HILL—A low rounded dome-shaped hill composed of recent strata derived from silurian rocks. Its shape is due to denudation.

MAIN-BRACE—The platform at the mouth of a shaft, to which the trucks of auriferous dirt are removed from the cage. *See* BRACE.

MAIN-SHAFT—*See* ENGINE-SHAFT.

MAKE OF REEF OR QUARTZ—The apparent re-formation of a reef.

MAN-HOLE—An aperture cut in the ladder sollar for the passage of miners in ascending or descending a shaft by the ladder-way. The opening in the boiler of an engine, through which access is obtained for the inspection or cleaning of the inside.

MATE—One engaged with others in mining operations, or prospecting. A friend. A companion.

MIA-MIA—A construction composed of four upright poles fixed securely in the ground or mullock about a shaft, with other four poles placed horizontally across on the tops of them. Branches of trees and brushwood are then spread from one horizontal bar to another, and thus a roof is formed to protect the miner at the windlass from the weather.

MICE-EATEN QUARTZ—Quartz from which decomposition has removed sulphides, &c., and left an irregularly jagged appearance resembling that presented by a thing which has been gnawed by mice.

MILL—Crushing machine, Puddling machine, Chilian mill—a general term for such machinery. A pass.

MILL BATTERY—A crushing machine with Chilian mills attached to it.

MINE-FORCE—The number of persons employed in a mine.

MINER'S RIGHT—A document which can be obtained by any person on the payment of a sum at the rate of five shillings for every year, not exceeding fifteen, for which it is to be in force. It permits the holder to take possession of Crown lands under the mining board bye-laws of the district; to cut, construct, and use races and dams, &c., &c., for gold mining purposes, and to

occupy for residence purposes not more than a quarter of an acre of Crown lands. A consolidated miner's right may be taken out for all the land held by a mining company on payment of a sum equal to that which would be paid for all the miners' rights that the consolidated right represents. See clauses 4-8, &c., of *The Mining Statute* 1865.

MONKEY-SHAFT—Is a shaft rising from a lower to a higher level (as a rule perpendicularly), and differs from a blind-shaft only in that the latter is sunk from a higher to a lower level.

MOP—A piece of old rope or other material formed into a ring and encircling the drill used in boring a hole. It prevents the water or sludge from jetting out at each stroke of the hammer.

MOTIVE-POWER RIGHT—The privilege of diverting water for motive power.

MULLOCK—Rubbish, dirt, stuff taken out of a mine—the refuse after the vein stuff is taken away; pyritous slate, &c., &c.

NUGGET—A lump of gold. The modern form of *niggot*.

OPEN CUTTING—An excavation made for the purpose of getting a face wherein a tunnel can be driven either for mining veins or alluviums. An *open-cast*. A quarry on a quartz vein.

OPENING-OUT—When a shaft intersects “drift” it is often found necessary to increase its size (which operation is called *opening-out*), for the purpose of forming a puddle wall behind the sets of timber in a shaft.

PADDOCK—An excavation made for procuring washdirt in shallow ground. A place built near the mouth of a shaft where quartz or washdirt is stored.

PAINT-GOLD—Gold found in cement, of such remarkable fineness as to resemble paint or gilding.

PAN—A large shallow enamelled-iron basin used in panning-off. A shallow tin dish.

PANNING-OFF—The process by which gold is separated from the gravel, &c., left in the cradle or sluice in alluvial washing, or from the crushed quartz, &c., remaining in the stamper-boxes in quartz crushing. So called from a metal pan or dish being used in the operation of *panning-off*.

PASS—An aperture left open in the workings, through which communication is held between the backs and the drives. They serve as outlets through which quartz or other vein-stuff can be conveyed, as well as for purposes of ventilation.

PATCHY—Characterising alluvial ground where the rich washdirt occurs in patches, and vein-stuff where the gold is distributed irregularly.

PAWL, PAUL, OR PALL—The iron tongue or catch which passes over the teeth of a ratchet-wheel when revolving in one direction, but which catches in the teeth and prevents the wheel from turning in the opposite direction.

PERMIT—A document issued by a gold commissioner or a warden authorising a miner to take or divert water from a creek or stream or to store water.

PICKER—A thin-pointed iron instrument having a handle. It is used for picking out the tamping from a blast-hole which has missed fire.

PILE—A pointed slab. A fortune. A miner who has got a great deal of gold is said to have “made his pile.”

PILING—A method of sinking a shaft through drift, by driving piles down into it behind frames of timber.

PILLAR—A portion of the virgin ground left in mining to support the roof or wall. An artificial pillar of masonry to support drives.

- PILLAR-DRIVE**—A wide irregular drive, constructed in firm dry ground, without the use of timber, in which the roof is supported by pillars of the natural earth, or by artificial pillars of stone.
- PINCHED OUT**—A reef is said to be *pinched out* when it is wedge-shaped or runs out. See **GASH-VEIN**.
- PIPE-CLAY**—A soft white clay, which is often found lying between the bed-rock and the washdirt. Its thickness varies from a mere trace to many feet.
- PIT**—See **SHAFT**.
- PITCH**—A portion of a mine let to a number of miners to work on terms.
- PITMAN**—Usually restricted to one who attends to the pumps and timber of the engine-shaft and the security of the permanent levels, &c. One who works in a pit.
- PLAT**—A chamber or excavation made at the point of departure of a level from a shaft.
- PLUGGING**—Plugging is resorted to when drift water has forced its way through the "puddle-clay" into a shaft. Holes are bored through the slabs near the leakage point, and plugs of clay are forced into them. This operation is continued at different points, until the leak is stopped.
- PLUNGER**—The cylinder used to force water up a column of pumps.
- PLUTONIC**—Applied to deep-seated igneous forces which (it is supposed) have produced the granites and certain porphyries.
- POCKET**—A crevice containing gold either in the bed-rock or in the quartz of a reef.
- POPPET HEADS**—Cross pieces of timber above the mouth of a shaft, on which rest the axles of the pulleys or sheaves which guide the ropes attached to the cages or tubs in the shaft. Commonly applied at Ballarat to the whole erection (consisting of walls and roof) which covers the shaft and the brace.
- POTHOLE**—A hole in the bed-rock, or a small area which is lower than the surrounding bed-rock.
- PROP**—A piece of timber varying in length and diameter, and used in the securing and working of a mine. *Props* are sometimes made use of singly to support detached pieces of loose ground.
- PROSPECT**—The yield of gold got from a dish of washdirt, or from the bottom of a shaft, or from roughly reduced quartz.
- PROSPECTOR**—One engaged in searching for gold or other metals or minerals.
- PROSPECTOR'S CLAIM**—A larger claim than ordinary, and obtained as a reward for a discovery. Prospectors are permitted under the provisions of the *Mining Statute* and by the Mining Board Bye-Laws to occupy larger areas than ordinary claims.
- PUDDLE-CLAY**—The tough clay made use of in puddling a shaft.
- PUDDLING A SHAFT**—Damming back water by ramming tough clay between the slabbing or timber of a shaft, and the rock or drift, &c., through which the shaft may be sunk.
- PUDDLING MACHINE**—A puddling machine consists of a circular space, the sides and bottom of which are lined with iron or laths of hardwood, with a perpendicular shaft moved by steam or horse-power, working in the centre of a circle. To the shaft are attached two harrows, which are dragged around the circular space, puddling the washdirt with which it is charged. Water is supplied in sufficient quantities to keep the charge in such a condition as to admit of its being puddled by the action of the harrows. The gold is left in the bottom of

the circular space, and is finally cleaned by panning. Figs. 88 and 89 show a plan and section of a common horse puddling machine.

PULLEY—*See WHIP.*

PUMP-BUCKET—A packed piston having an aperture in its centre covered by a clack or valve opening upwards. It is placed in a smoothly-bored cylinder near the bottom of a lift of pumps (which *see*).

QUARTZ-BOIL—An outcrop of a quartz reef on the surface, or an outburst or extension in width of the reef beneath it.

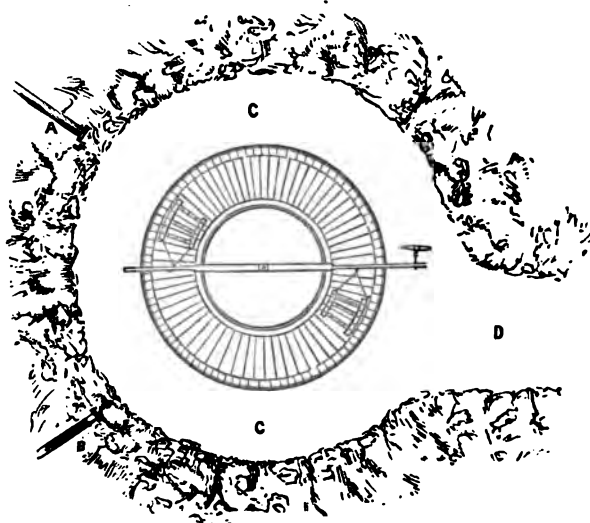
QUARTZ-REEF—A lode or vein of quartz.

QUICKSILVER CRADLE WITH SLUDGE TROUGH—Figs. 90 to 93 show a sketch, a plan, and sections of this gold-washing machine. The plan and sections are drawn to a scale of six feet to one inch. An overshot

water-wheel, eight feet in diameter, affords the motive-power to work it. This power is communicated to the puddling-shaft by two drums and a belt, and to the cradle by a rod connected to a crank fixed at the other end of the puddling-shaft. The washdirt is thrown into the puddling-trough, which is supplied with water, and in which revolves a shaft or axle armed with twenty-five iron spikes. From this trough the washdirt, which is mixed with water, flows on to the hopper at the top end of the cradle. There are seven tiers of blanket-tables in the cradle, which so vary in length, that each one receives from the hopper its due proportion of sludge. The blankets are washed three times a week, and the slime from them concentrated in a small cradle of the ordinary construction, and the gold finally amalgamated. The cradle has a pitch or fall of six inches, and an oscillation of twelve inches. The blanket-tables are made of quarter-inch pine boards, and the hopper-bottom of iron pierced by $\frac{3}{8}$ inch holes.

RACE—An aqueduct, a canal, or artificial watercourse used for conveying water from a stream, a spring, or a dam, to a mining claim or a mill. Races are cut through soil and rock, and where a saving in length is to be gained by crossing a gully instead of skirting a hill, the water is conveyed in flumes (boxes or troughs constructed of wood).

FIG. 88.



PLAN.

A Water supply drain.
B Discharge drain.

C Horse-walk.
D Roadway.

FIG. 89.

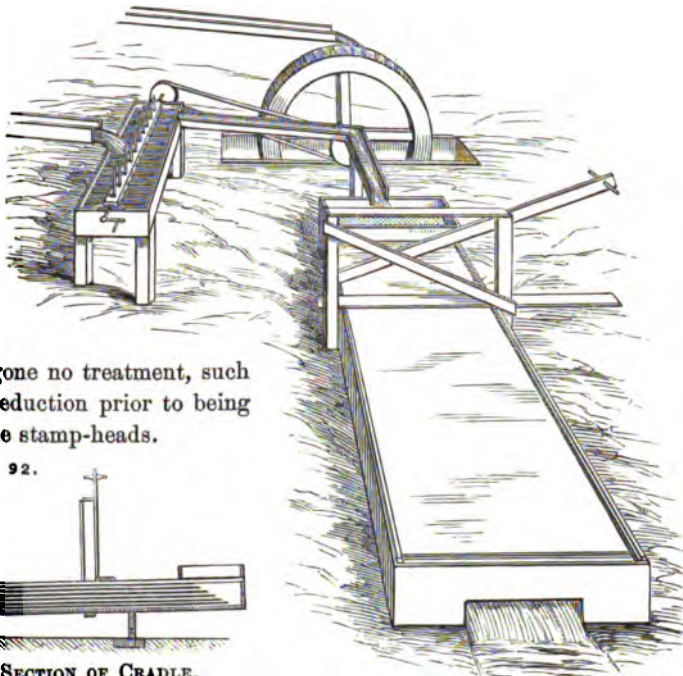


SECTION.

RANGE—A chain of hills. In Australia the main line of high ground to which the coast line is rudely parallel, and which stretches from Cape York on the north to Wilson's Promontory on the south, is called the Main Dividing Range or Cordillera. Subordinate ranges connected therewith (not necessarily less elevated) are called *spurs*.

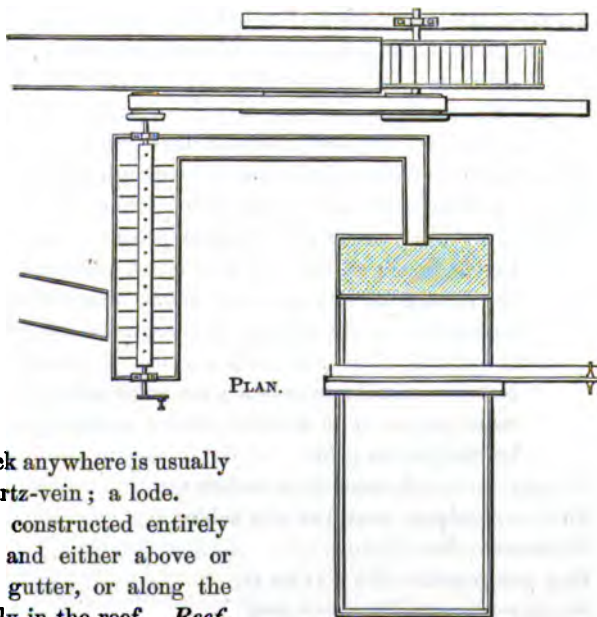
RAW QUARTZ—Quartz that has undergone no treatment, such as burning or reduction prior to being placed under the stamp-heads.

FIG. 90.



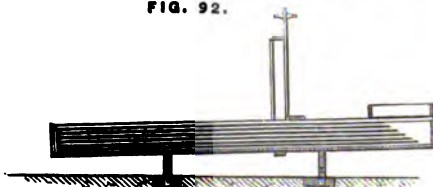
SKETCH.

FIG. 91.



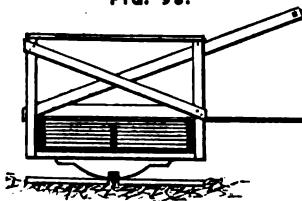
PLAN.

FIG. 92.



LONGITUDINAL SECTION OF CRADLE.

FIG. 93.



TRANSVERSE SECTION.

REEF—The term is applied to the up-turned edges of the palæozoic rocks. The reef is composed of slate, sandstone, or mudstone. The bed-rock anywhere is usually called the reef. A quartz-vein; a lode.

REEF-DRIVE—A drive cut or constructed entirely through the bed-rock, and either above or below the level of the gutter, or along the face of the reef, or partly in the reef. *Reef-drives* are usually cut for the purpose of seeking the gutter, or seeking reef-washes, or working out reef-washes, or as air-drives for ventilation.

- REEF-WASH**—A deposit of washdirt spread over an expanse of flat or undulating reef (i.e., bed-rock), or lodged in a hollow in the reef, above the level of the gutter. For example: towards the junction of two leads the wall of reef or bed-rock by which the two leads are separated appears in some cases to be worn or broken down, and an expanse of flat or undulating reef is left between the two gutters, and above the level of the gutters this reef, if covered by a deposit of washdirt, would be termed a *reef-wash*. Again, where the reef (as sometimes happens) on one side of the gutter spreads out at a higher level than the gutter, and a channel containing washdirt is found running alongside the gutter, and between the gutter and the wall of reef, it is called a *reef-wash*.
- RIDDLE**—A small dish having a perforated bottom. It is used as a sieve to divide the coarse gravel from the silt, after the operation of cradling, and before panning off.
- RIDER**—A detached mass of the bounding rocks enclosed in the vein. *See* HORSE OF GROUND.
- RIPPLE OR RIFFLE**—A groove about one inch in depth at the lower side, and diminishing towards the upper; and with a width of about three inches. It is cut across the ripple-board table, and when the table is in work the ripple is nearly filled with quicksilver. In box-sluices small wooden bars or *ripples* are fixed across the lower end of each box.
- RIPPLE-BOARD—RIPPLE-BOARD TABLE**—An inclined plane, of lengths varying from about eight to fourteen feet. Ripples are cut in it at about two and a-half feet from each other. All the reduced quartz from the stamper-boxes passes on to and over these *ripple-board tables*.
- RISE**—Work done in the back of a level. The upper portion of a stope. *See* JUMP-UP.
- RIVER-CLAIM**—A claim that includes the bed of a river.
- RIVER-RIGHT**—The privilege of diverting water for the purpose of working a river claim, or of diverting water from a river.
- ROCK**—Where there are two or more distinct layers of basalt, the upper layer is termed the first *rock*, the one next beneath it the second *rock*, and so on.
- ROCK-WATER**—Water that percolates through rock. *See* ROCK.
- ROOF**—The upper portion of any underground excavation, or the hanging-wall.
- ROYALTY**—A duty claimed on mineral produce. The export duty on gold, abolished by enactment on the 31st December, 1867, was, in its nature, a royalty; just as the charge on minerals and metals other than gold now, by the regulations, amounting to £2 sterling per cent. on the value of the mineral or metal at the mouth of the mine, is a royalty. It is imposed, not for purposes of revenue, but in order to ascertain with some accuracy the quantities raised. For the same purpose it is desirable that a small export duty, say 3d. an ounce, should be charged on gold.
- RUBBLY-REEF**—A vein much broken up.
- RUNG**—A step or cross-bar of a ladder.
- RUNNERS**.—*See* GUIDES.
- RUN TOGETHER**.—*See* CAVED IN.
- SADDLE-FORMED REEF**—A reef the upper portion or cap of which has the appearance of an inverted V.
- SAFETY FUSE**.—*See* FUSE.

SCRAPER—An instrument used for cleansing a hole which is being bored or drilled.

SEAM—Usually any horizontal layer, as a *seam of coal*. It is as inaccurate to speak of a vein of coal as of a *seam of quartz*.

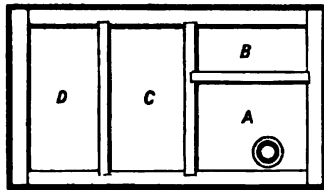
SET OF BEARERS.—See **BEARERS**.

SET-OFF—An iron projection from the main pumping-rod on which the bucket pumping-rod is fixed. A *set-off* follows the fixture of a plunger.

SET OF TIMBER (for a level)—Consists of a ground-sill, two leg-pieces, and a cap-piece. The ground-sill is laid across the bottom of the level, the two leg-pieces rest one on each end of it, and the cap-piece is fitted across on the top ends of the leg-pieces. (These *sets of timber* are employed for securing drives or levels, and they are placed at distances varying from four to six feet, and are connected by slabs.)

SET OF TIMBER (in a shaft)—Is composed of four pieces of sawn timber, jointed together in a rectangular or other form to fit the sides of the shaft. They are

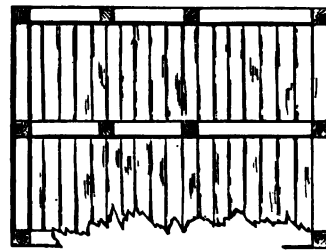
FIG. 94.



PLAN OF SHAFT.

- A Compartment for the pumps.
- B Compartment for the ladders.
- C D Compartments for the cages.

FIG. 95.

LONGITUDINAL SECTION OF SIDE OF
SHAFT.

fixed at distances less than five feet apart. Figs. 94 and 95 illustrate the mode of securing a shaft with timber.

SHAFT—A pit. A hole sunk in the ground. A rectangular or square pit sunk on a reef or on a gutter.

SHAKING-TABLE—A slightly inclined ripple-table, which receives a peculiar motion from an eccentric.

SHANK—See **LIFTER**.

SHEARS—**SHEERS**—See **POPPET-HEADS**.

SHEPHERDING—The holding possession of claims by doing the minimum amount of labor enforced by the mining bye-laws. A system whereby auriferous lands are monopolized by speculators and idlers, often to the injury of the industrious miner.

SHIFT—The period during which a miner works in a mine. There is the day-shift and the night-shift.

SHOOT—A place for quartz or washdirt, beneath which tram-waggons are filled by raising a slide-door. A run of gold in a quartz reef, or the re-formation of quartz in a reef. An inclined wooden spout through which vein-stuff is conveyed.

SHOT—The firing of powder or gun-cotton in a blast.

SHOTTY GOLD—See **HEAVY GOLD**.

SICKENING—See **FLOURING**.

SIDELONG REEF—An overhanging wall of bed-rock in alluvial formations, running parallel with the course of the gutter, and generally only on one side of it.

- SIEVE**—This term is sometimes used to denote the gratings fixed in stamper-boxes. A gold sieve is a small tin dish which has a wire gauze bottom, and is used by gold-buyers to separate the heavy gold from the lighter or fine gold and dust.
- SINGLE CLAIM**—A parcel of ground which one miner is entitled to hold.
- SKIDS**—Wooden rails or guides on which sledges, trucks, buckets, or bags, slide or run.
- SKID-SHAFT**—A shaft sunk more or less on the underlie, and in which the buckets slide between two wooden rails or skids.
- SLABBING**—Close timbering between sets of timber. *See* SLABS.
- SLABS**—Split pieces of timber, of from four to six feet in length, two to three inches in thickness, and seven to fourteen inches in width. They are placed behind the sets or frames of timber in shafts or levels, and span the distance from the centre of one set to that of the next.
- SLATE CASING**—*See* CASING.
- SLEEPING PARTNER**—A shareholder in a claim who does not work in it. One who supplies capital only. Sometimes called a *furnisher*.
- SLIDE**—A vein of clay intersecting a quartz reef. A flucan. The perpendicular wooden structures on which cages move in a shaft are called slides.
- SLUDGE**—Mud flowing from a puddling machine. "Tailings" is the word usually applied to the stuff flowing from a quartz-mill.
- SLUDGE-MILL**—A puddling machine in which the sludge from another machine is washed.
- SLUICE-BOX**—A flume with ripples or false bottoms, having holes bored in them for catching gold. It is a simple, and when properly used, an effective gold washing machine; its thoroughness depending principally on its length.
- SLUICE-HEAD**—A box fixed at the head of a water-race to gauge or measure the quantity of water diverted from a river or stream. The measure of the quantity of water which a miner may divert under the bye-laws. He may divert one or more sluice-heads, according to the extent of his *permit*.
- SOFT-DIG**—The softest portion of a reef or lode. Applied to the soft vein sometimes found on the side of a lode.
- SOLEPLATE**—*See* FOOTPIECE.
- SOLLAR**—A wooden platform fixed in a shaft as a rest for ladders or for other purposes.
- SPANGLE GOLD**—Gold in the form of smooth flat scales.
- SPECIMEN**—A piece of quartz containing gold which is visible to the naked eye.
- SPENT SHOT**—A blasting hole which has been prepared for blasting and fired, but which has not rent or broken any rock. Fissures in the rock are often the cause of *spent shots*.
- SPUR**—An irregular quartz vein. A subordinate range of hills: Thus we say "a spur from the Great Dividing Range."
- STACK**—A mound of quartz, washdirt, cement, tailings, or timber. Protection is provided by the Mining Bye-Laws for these. Applied sometimes to a brick chimney.
- STAMPER-BOX**—An oblong cast-iron box in which the stamp-heads work. One, and sometimes two of its sides are open, and in these spaces the gratings are fixed.
- STAMP-HEAD**—A cast-iron weight or head fixed on to a shank or lifter, and used for stamping or reducing quartz to a fine sand. *See* CRUSHING MACHINE.

- STAY**—A piece of timber laid across a shaft to maintain the pumps or pump-rods in a vertical position.
- STONE**—Broken quartz or the quartz in a reef.
- STOPE**—*See* STOPING.
- STOPING**—Working out the reef upwards between two levels by steps or stopes carried forward one after the other (about six or more feet in height), at such distances that the working of the upper stope shall not interfere with the next beneath it. This *stoping* continues until eventually the whole height of the reef between the two levels is in work. *Stoping* in alluvial mining is levelling the bottom of a drive.
- STOW**—To pack a drive with stone or mullock in such a way as to give support to the roof.
- STRAKE**—A slightly inclined table or trough for separating gold from quartz tailings, sulphides, &c.
- STRIKE**—The inclination or fall of a reef in its course; exhibited in the cap, or sometimes in the thinning out or re-formation of a reef. The line of outcrop of a stratum. The dip is necessarily at right angles to the strike.
- STRIPPING A GUTTER**—Removing the headings from off the washdirt, which is left undisturbed.
- STRIPPING A REEF**—Baring the quartz, by removing the casing and strata usually on the footwall side of a quartz reef, preparatory to breaking it down.
- STRIPPING A SHAFT**—Taking out the timber from an abandoned shaft. Trimming or squaring the sides of a shaft.
- STUDDLE**—A piece of squared timber placed vertically between two sets of timber. Its length is determined by the distance between the sets. Four studdles are commonly used, one in each corner of the shaft; but, in large shafts, six are sometimes used.
- STULL**—Logs of wood laid across the workings at intervals of about five feet, with an elevation to the hanging-wall of 50° to 75° . The lower end of a *stull*-piece is cut in rather a peculiar manner, and fitted into a hitch in the footwall, and the upper end is fixed against a head-board placed on the hanging-wall. These *stull*-pieces are covered with laths or slabs, and form a storage place for mullock. *Stulls* are used in backs of drives, which were not previously timbered when the reef or lode was stoped away.
- SUMP**—The bottom portion of an engine shaft beneath the deepest level. The lowest part of a shaft, into which the water from the workings flows.
- SWOB-STICK**—A stick about the same size as a drill. It has a frayed mop-like end, which is inserted in the bore-hole for the purpose of cleaning out the sludge formed during the operation of boring, and for drying the bottom of the hole.
- TACK**—Sometimes applied to vein-stone, which is much mixed with mullock; or to slate, or sandstone, different from that usually met with.
- TAILINGS**—The *detritus* carried off by water from a crushing machine or any gold-washing apparatus.
- TAILINGS MACHINE**—A crushing machine for reducing and extracting the fine gold from the quartz tailings run off from a crushing machine.
- TAIL-RACE**—An artificial channel which drains a claim, or which conveys water from a claim, or a mill, or a puddling machine, after it has been used.
- TAIL-WATER**—Water that has been used or passed through a tail-race.

- TAMPING**—The clay, soft slate, or sandstone, or other similar material, which is hammered very tightly down on the wad of a blasting hole.
- TAMPING-BAR**—An iron instrument, one end of which is shod with three inches of copper. It is used for beating down the tamping on the wad. Sometimes it is made of hardwood, in which case one end is bound round with an iron ring. This end is beaten with the hammer.
- THROWN**—A reef is said to be *thrown* when it is cast out of its true course by a fault, a slide or cross-spur, or the like.
- TON OF FIREWOOD**—Fifty cubic feet of firewood ; but, in some mining districts, one ton means forty or sixty-four cubic feet.
- TOR**—A rounded mass of rock left by the decay of surrounding parts in elevated situations. The tors on our granite ranges are usually incorrectly called *boulders*.
- TORMENTOR**—This machine was introduced as an improvement on the mode of puddling by the tub and spade. It is composed of a wooden-axle studded with $\frac{1}{2}$ -inch iron spikes working in a trough—which is often rudely formed of the half of the hollow trunk of a tree. The ends of the trough are formed of boards let into grooves. These boards form the bearers of the axle, and to each end of the axle are fixed hook-handles, which, when in work, are rapidly turned by men. As the water in the trough gets thick it is run off at the ends, and when the stuff is sufficiently puddled, the *tormentor* is taken off, and the boards are withdrawn from the grooves one after the other to drain off the sludge during the operation of cleaning off. "Harrow's" of puddling machines are sometimes called tormentors.
- TRIBUTER**—One who contracts to work a mine or claim for nominal wages, and a fixed share of the products, or for a percentage only.
- TROUBLE**—*See* FAULT.
- TRUCK**—A tram wagon used in removing stuff from underground workings to the crushing machine or puddling machine on the surface, or to the mullock heap. The cheating of workmen by pretending to pay them for their labor in food or the like, instead of honestly paying them wages.
- TUCKER**—Bare subsistence.
- TUCKER GROUND**—Ground which yields only sufficient gold to provide miners with *tucker*.
- TUNNEL**—A level put in from the side of a hill, or from the bank of a river, to mine washdirt or a quartz reef, or for drainage purposes.
- TUNNEL CLAIM**—A claim worked by means of a tunnel.
- UNDERLIE** (commonly called **UNDERLAY**)—The dip or inclination of a reef or lode. The angle of inclination from the plane of the horizon or level.
- UNITED CLAIM**—A number of claims which have been amalgamated.
- VEIN**—A reef. A lode.
- VOLCANIC**—Applied to igneous forces which are now or have been active at the surface, in contradistinction to igneous forces whose seat of action is beyond ken.
- WAD**—A piece of old rope or thick paper put into a blasting-hole after it has been charged with powder, to prevent the powder from coming into contact with the tamping. Protoxyd of manganese.
- WALL**—A portion of unworked ground lying between adjoining claims.
- WALLS OF A REEF**.—*See* **HANGING-WALL** and **FOOT-WALL**.
- WALL-PLATES**—The two longest pieces of timber in a set, in a rectangular shaft.

WARDEN—An officer having judicial and other powers and duties. *See* sections 38, 176–211, &c., of the *Mining Statute* 1865.

WASHDIRT—The auriferous gravel, sand, clay, or cement in which the greatest proportion of gold is found.

WASHDIET DRIVE—A drive cut or constructed wholly or partly through or in wash-dirt.

WASHING—The whole operation of cleansing gold from washdirt.

WASHING-OFF—WASHING-UP—The cleaning out of the boxes, tables, blankets, &c., &c., in quartz crushing, and of the puddling machines, buddles, sluices, &c., in alluvial washing. The resulting gold is got by this operation. The last process of separating gold from the associated sand, &c., by hand, after the process of separation has been carried to its utmost limit by machinery.

WATER-BOSS—A holder of water privileges who does not himself use the water for mining, but sells it to miners and machine-owners.

WATER-HOLE—A small natural or artificial reservoir. On the goldfields the water caught in such holes is sometimes conserved for household purposes by the miners. Under the mining bye-laws protection is given to *water-holes* where water is conserved for domestic purposes.

WATER-LINE—The line in any reef where water is struck in the several shafts.

WATER-RIGHT—The right (in what manner soever acquired) which a miner enjoys who takes or diverts water from a spring, lake, pool, creek, or reservoir.

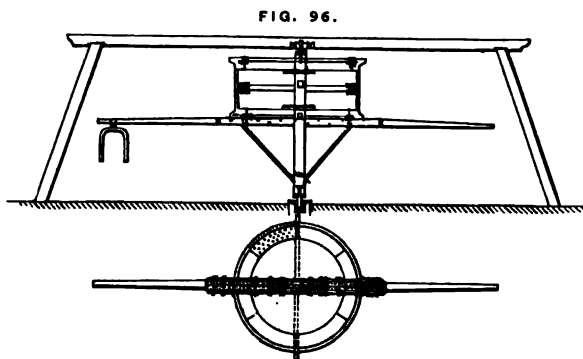
WATER-SHAFT—The drainage-shaft, usually the deepest shaft in a mine. *See* **ENGINE-SHAFT**.

WATERSHED—The relatively elevated land which divides drainage areas. The Australian Cordillera is a watershed. All the waters which fall from the clouds run on the west side of the line into the River Murray, or other rivers having a westerly course, and on the east side into the several rivers which run easterly to the sea. In the elevated parts of the great spur there are flat, swampy tracts, which in very wet seasons discharge their waters through two or more outlets into separate drainage areas. A watershed does not necessarily imply a range of considerable elevation. This word has been much abused by geographers. Restricted to its ordinary use, it could never mislead.

WATER-WORN—Worn by the action of water. Stones and fragments of rock found in the beds of streams, and rounded by the action of running water, are said to be *water-worn*.

WEATHER-WORN—Rocks which are rounded or honeycombed by the wind and weather, or by sea-spray, are *said to be* weather-worn.

WHIM—A structure of strong timber keeping in position a large horizontally working drum, around which the ropes attached to the buckets working in the shaft are wound. Underneath the drum there is a long beam with shafts, to which the horse is harnessed. Fig. 96 shows a plan and section of a whim.



VERTICAL SECTION AND PLAN OF A HORSE-WHIM.

WHIM-BUCKET—A bucket made of wood and bound strongly with iron. It is used for raising quartz to the surface, for baling, lowering timber, and other purposes.

WHIP—A post about twenty feet in length, fixed at an angle of about 45° to the ground, in which it is firmly embedded. The thinnest end of the post rises about eight feet above the centre of the mouth of the shaft. At this end is fixed an iron wheel or sheave, having a grooved circumference, in which a rope runs. At one end of this rope is fastened a bucket, which is raised or lowered by a horse travelling backwards and forwards.

WINDBORE—The bottom or suction pipe in a lift of pumps.

WINDLASS-BARREL—The roller on which the rope of a windlass winds.

WINDLASS-STAND—The two uprights in which the axle of the windlass-barrel is fixed, and on which it revolves.

WINDSAIL—The top part of the canvas piping which is used for conveying air down shallow shafts for ventilating purposes. This portion of the piping is open, and on each side of it is fastened a wing or sail, which is spread out to catch the wind.

WINZE—A small shaft sunk in the bottom of a level, or between two levels, for ventilation, or for working the reef, or for communication. *Winzes* often become passes. *See* PASS.



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